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DATA ACQUISITION REDUCTION AND ANALYSIS USING A
MICROCOMPUTER(U) CHEMICAL RESEARCH DEVELOPMENT AND
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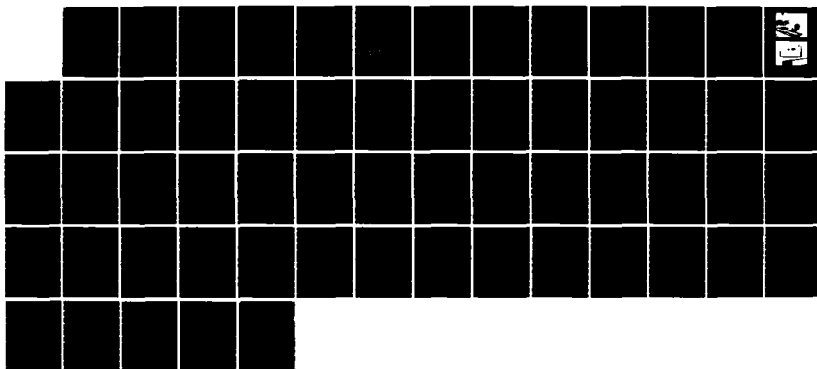
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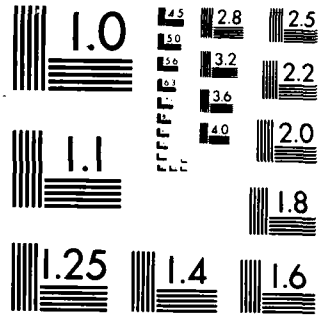
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CHEMICAL
RESEARCH,
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CENTER

CRDEC-TR-86083

DATA ACQUISITION, REDUCTION, AND
ANALYSIS USING A MICROCOMPUTER

by Bruce M. Allen
MUNITIONS DIRECTORATE

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PREFACE

The work described in this report was authorized under Project 1L162622A554, Chemical Munitions and Chemical Combat Support. This work was started in October 1984 and completed in June 1985.

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DATA ACQUISITION, REDUCTION, AND ANALYSIS USING A MICROCOMPUTER

1. INTRODUCTION

Manual entry of data into a computer has been a significant problem since the invention of computers. In order to process data (in most cases), information must be typed into the computer. Manual entry of data is a laborious task when compared to reading data from a disk or receiving data from another electronic source. Many different types of electronic equipment are used to collect data from experiments. This equipment generates large amounts of data usually in the form of script charts or printed columns of numbers. Script charts are usually graphs of voltage versus time, and discrete data points must be measured and converted to a final result using correlations. This data is then manually entered into the computer for reduction and analyses. This report describes one method of eliminating the manual entry of test data. This approach applies to many data collection situations.

2. PROBLEM DEFINITION AND RESULTS

The problem encountered was the evaluation of the results of liquid dissemination tests of chemical munitions. A liquid-filled munition releases its contents over a grid on the ground. The information required from the test are the sizes of the liquid droplets that are disseminated. Witness cards are used to collect falling droplets. The witness cards are a statistical sample of the liquid falling on the grid. The stain diameters on the witness cards can be measured, and from this information droplet diameters, percentage of grid coverage, and mass liquid recovery may be calculated. The stain diameters of the droplets were measured using a commercial image analyzer, the Quantimet 900. The stain diameters may be used to calculate the droplet diameters which originally fell on the card. Several properties of the liquid droplets may be determined such as mass median diameter, mass mean diameter, and number median diameter. Dissemination tests can involve as many as 10,000 cards. The problem of card analysis was divided into two parts: (a) the analysis of the cards for spot diameters (stain diameters) and total number of spots, and (b) the analysis of the data to produce the desired information about the droplets produced in the test.

The current method of analysis reads the individual witness cards with an image analyzer. The spot diameter data is then manually entered into a computer for reduction. The image analyzer was built around a PDP-11 computer with a camera peripheral which enables a picture of a specific area of a card to be placed into the memory of the computer. The image is then manipulated by algorithms to determine the sizes and total number of spots on a card. The information generated for one card is printed out on one sheet of paper. Therefore, a test consisting of 10,000 cards would generate a rather large volume of paper. This process led to a large data entry job and was the major obstacle to obtaining useful results from the card data.

Two solutions to manual entry were available, but one solution proved more cost effective. The first solution called for procuring additional hardware and software from the manufacturer of the image analyzer. The image analyzer has two 8-inch floppy disk drives and was able to record card data; however, additional computer memory was required to do data reduction. In addition, a Pascal language compiler and system linker were required to write programs to run on the image analyzer. The total estimated cost for this solution is given below:

Memory Expansion Kit	\$4,000
System Linker	\$5,000
Pascal Compiler	\$3,000
Total	\$12,000

This \$12,000 was the minimum it would cost to reduce the raw data using the image analyzer. The programmer was restricted to writing programs which link into the existing image analysis program. In order to use the image analyzer as a true PDP-11 computer, an additional purchase of the RT-11 operating system would have been required.

The second solution was to find a way of interfacing the image analyzer to a computer so that data could be dumped to the computer. This solution was the cheapest way to collect and reduce the raw data using an external computer. The computer used was a desktop, \$3,000 microcomputer which uses the MS-DOS. There are some factors which were not evaluated for cost; but when you consider these factors, the second solution becomes even more appealing. These advantages of the second solution are:

- Since the microcomputer, its operating system, and the BASIC language were already known, the data reduction program could be written in a more direct manner compared to writing the same program for a foreign computer system.

- The microcomputer used 5 1/4-inch floppy disks which are standard for over 99% of all desktop computers using MS-DOS. The standard-sized disks allow easy interchange of data between microcomputers.

- The microcomputer could communicate with almost any other computer by means of an RS232 interface. Therefore, it could transfer data to computers which cannot read its disk format.

Writing a computer program in a known environment is two to three times easier; therefore, any costs incurred in writing a BASIC program could have been doubled or tripled if undertaken by the first solution. Using the first solution may have led to manual entry eventually if the raw or reduced data had to be transferred to an external computer or a central data storage site. By examination

of the above three points and the hardware costs, we see that the second solution has many advantages over the first solution.

The connection of the image analyzer to the microcomputer was accomplished by use of RS232 ports. The image analyzer uses an RS232 port to communicate to its printer. By analyzing the pin settings on the printer, the correct communication parameters could be determined. These parameters could be set by software in the computer. The only additional piece of hardware required was a smart cable. This cable basically interconnected the "receive" pin on the microcomputer with the "send" pin on the image analyzer. This was necessary because the microcomputer had an asynchronous port which would have connected the two "receive" pins. The printer was then connected to the microcomputer by means of a parallel port. In this case, the printer was able to function as either a serial or parallel printer. When data was dumped from the image analyzer, the data was received by the microcomputer and written directly to the disk drive. An optional hard copy could be received from the printer; however, this was not done since floppy disks are highly reliable, can be backed up, and reduce the risk of data loss. The hardware configuration is seen in Figures 1 and 2.

The factor which determines how easy or difficult the data collection and subsequent reduction will be is the power of the computer language employed. BASIC was used to write all programs connected with the image analyzer to date. The language allows for interrupts so that the computer could be doing data reduction while waiting for additional data to be sent from the image analyzer. Unfortunately, due to the massive amounts of data to be reduced, this feature of BASIC could not be capitalized on. A later version of this program could use this feature of BASIC. The following serial collection and data reduction scheme was devised. The flow chart in Figure 3 shows how the overall system of data collection and analysis functions. Appendix A contains the program listings.

The first block of Figure 3 represents data collection. In order to make this process as easy and error free as possible, the data collection program must be able to handle as many situations as possible. The program Takedata.asc (Figure A-2) does the following:

After the program disk is placed in Drive A and a format data disk is placed in Drive B, the computer is turned on and the program is automatically loaded into memory and searches for the raw data file on Drive B. If the raw data file is there, the program appends new data to the end of the file; otherwise, a new file is created. It is important to label disks because the program does not check to determine which disk has which test data.

While collecting data, the program generates a random pattern of ASCII characters on the monitor to let the operator know that the program is working correctly.

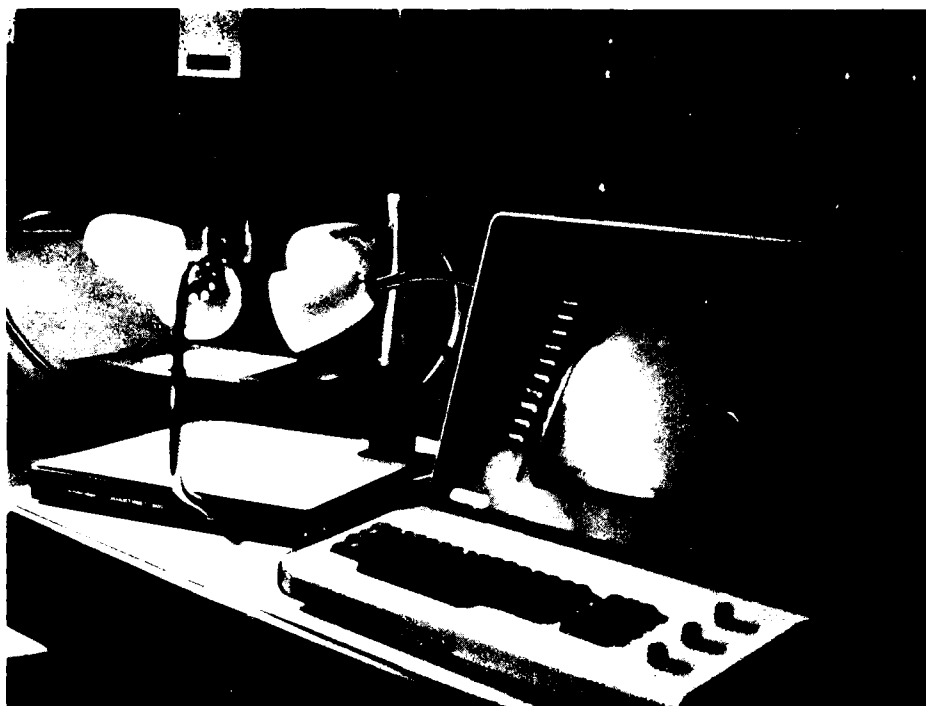


Figure 1. Image Analyzer Reading Dissemination Data Card

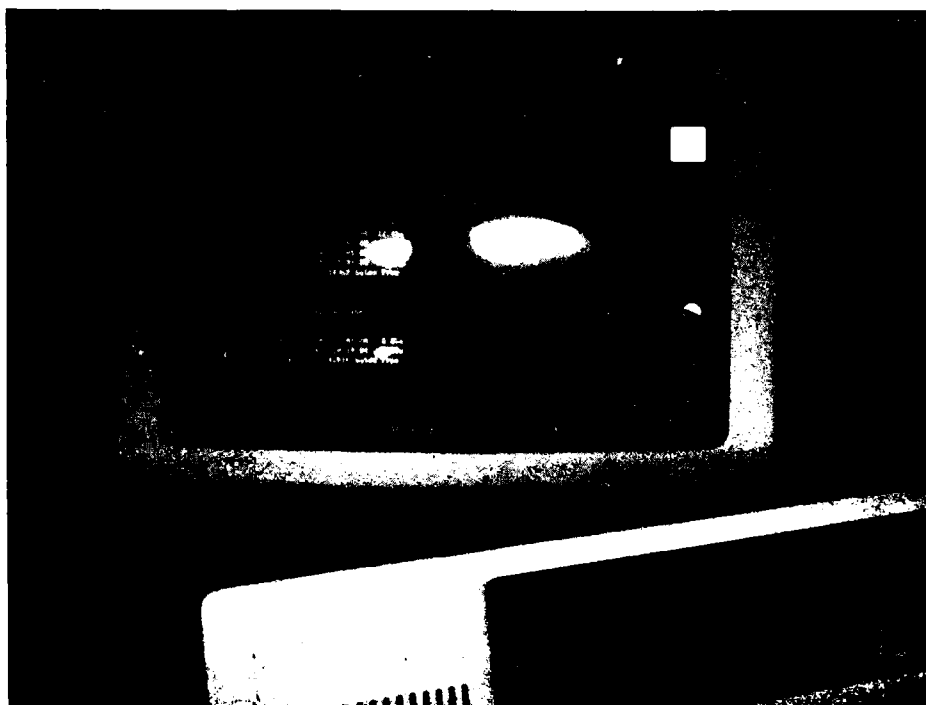


Figure 2. Microcomputer (IBM Personal Computer)

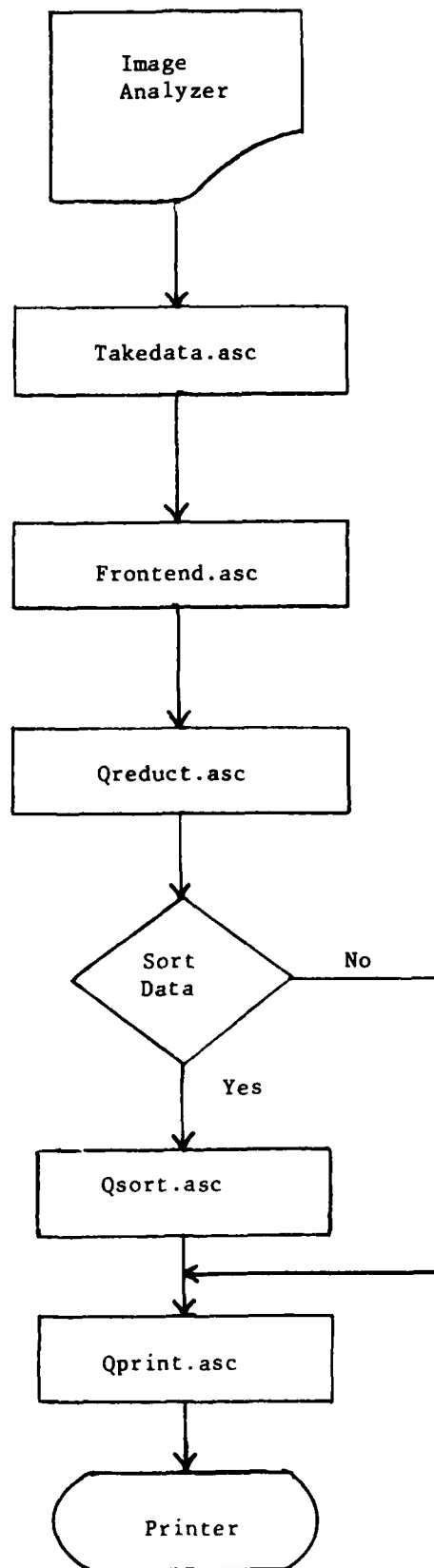


Figure 3. Flow Chart

Sequential card numbers are checked against one another to stop the reading of the same test card twice. If the same card is read again, the computer will alert the operator. In addition, if the operator enters an incorrect identification number into the image analyzer, the program will alert the operator to reread the card and enter the correct identification number.

The program also counts the cards read and will ask for a new data disk when the disk is full. These features are necessary because the operator can not be realistically tasked with entering data to both the computer and the image analyzer. The image analyzer was designed as a research instrument and not for working in a high-production environment. By entering data into the image analyzer and then transferring it to the computer, the goal of making the computer a data recorder, which does not require operator input, is achieved.

The second block in Figure 3 represents the initial phase of data reduction. In order for the computer to reduce data, the computer must have some information about the particular test; e.g., liquid density, constants of the stain diameter equation, and the test identification number. The stain diameter equation is a correlation between a diameter of a spot on a witness card and the actual diameter of the droplet which made the spot. The test identification number is used to create a file name for the reduced data. The program Frontend.asc (Figure A-3) creates a file with this and other test information.

The third block in Figure 3 represents the actual data reduction. The program Qreduct.asc (Figure A-4) reads the data file created by Frontend.asc and then generates the reduced data. The program first generates data about each individual card. If more than one data disk was used in data collection, the program prompts the user for the next data disk. Once individual card data is generated and written to Drive A, the accumulated size category data is written to Drive A. Finally, a file of overall test data is written to Drive A.

At this point, the user has a choice of sorting or not sorting data. This task depends on what is required and how the data was read initially by the image analyzer. If a circular grid was used in the dissemination test, the data may be sorted by radials (out from the source) or by zones (arbitrary distances from the source). The program Qsort.asc (Figure A-5) sorts data by zone and is included as an example of a sort program using the random file structure of Qreduct.asc. Depending on the grid used, each program user should write his or her own sort routine.

The fifth block in Figure 3 represents the printing of the reduced data. This program can print either sorted or unsorted data since it shares the same file structure as the previous programs. The program Printer (Figure A-6) prompts the user for background test data such as percent thickener, scan area, and liquid density.

This information is printed with the reduced data and raw data. Appendix B shows a sample printout.

3. CONCLUSION

The solution chosen is cost effective and allows users to change their programs easily so that many approaches to data reduction may be used. The manual entry of image analyzer data into an external computer is eliminated. In addition, this method of interfacing computers to laboratory equipment can be expanded to almost any type of equipment which has a serial interface.

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APPENDIX A
PROGRAM LISTINGS

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```

90 CLS
100 FOR L=2 TO 79
110 LOCATE 1,L:PRINT CHR$(205)
120 LOCATE 21,L:PRINT CHR$(205)
130 NEXT L
140 FOR L=2 TO 20
150 LOCATE L,1:PRINT CHR$(186); TAB(80) CHR$(186);
160 NEXT L
170 LOCATE 1,1 : PRINT CHR$(201)
180 LOCATE 21,1:PRINT CHR$(200)
190 LOCATE 21,80:PRINT CHR$(188)
200 LOCATE 1,80:PRINT CHR$(187)
210 LOCATE 5,32:PRINT " QUANTIMENT 900 "
220 LOCATE 7,31:PRINT " DATA AQUISITION "
230 LOCATE 9,37:PRINT " AND "
240 LOCATE 11,28:PRINT " DATA ANALYSIS PROGRAM "
250 LOCATE 13,27:PRINT " - IBM PC VERSION 2.0 - "
260 LOCATE 15,26:PRINT "          11 APR 85          "
270 LOCATE 17,26:PRINT " WRITTEN BY BRUCE M. ALLEN "
280 LOCATE 19,21:PRINT "Mun Dev Div, Mun Dir , CRDC , US ARMY "
290 FOR L=1 TO 3000:NEXT L
300 BEEP:FOR L=1 TO 550:NEXT L:BEEP
310 'CLS ':SYSTEM

```

Figure A-1. Header.asc

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```

70 GOTO 90
80 'ON ERROR GOTO 6000 :GOTO 90
81 OPEN "B:MASTER.FIL" FOR INPUT AS #6
82 IF NEW.FLG=1 THEN GOSUB 7000 :GOTO 90 'STARTING A NEW FILE MASTER.FIL DONT EX
IST
83 GOSUB 8000
90 DEX=1:INDEX=1:DIM NUM$(1,3):PRINT "FILE 6 IS CLOSED"
100 OPEN "COM1:9600,N,8" AS #1
110 OPEN"SCRN:" FOR OUTPUT AS #2
120 'OPEN"LPT1:" FOR OUTPUT AS #3
121 OPEN"B:RAWDAT.RAN" AS #4 LEN=50
122 FIELD 4, 10 AS LL$, 10 AS UL$, 10 AS CNT$, 20 AS ID$
130 ON COM(1) GOSUB 10000
140 COM(1) ON
141 ON KEY(1) GOSUB 25000
142 KEY(1) ON
145 V=LOF(1):INDEX=LOF(4)/50
150 X=1+INT( RND*(79+1))
155 IF (X>35) AND (X<45) THEN 145
160 YY=1+INT( RND*(21+1))
165 IF (YY>10) AND (YY<14) THEN 145
170 CHRR$= CHR$(INT( RND*(255+1)))
171 IF (CHRR$=CHR$(7)) OR (CHRR$=CHR$(10)) OR (CHRR$=CHR$(12)) THEN 170
175 LOCATE YY,X:PRINT CHRR$
180 GOTO 145
6000 VV=ERR
6010 IF VV=61 THEN 6500
6020 IF VV=53 THEN 6700
6498 PRINT #2,"ERROR TYPE UNKNOWN PLEASE CONTACT BRUCE M. ALLEN X3218 FOR HELP"
6499 CLOSE : END 'CANT FIND ERROR SAVE DATA EXIT PROGRAM FAST
6500 CLS:PRINT #2, "The raw data disk is full....."
6510 IF CRED < INDEX THEN FLG=1 : COM(1) OFF ELSE 6540
6520 PRINT #2, "Calculations are in progress, please take a break and I'll let y
ou know when to place a new disk in DRIVE B:"
6530 'CLOSE #4 :OPEN"B:RAWDAT.RAN" AS #4 LEN=50 :RESUME
6531 INDEX=LOC(1)
6532 SNUM$=ID$
6533 GET #1,INDEX
6534 IF SNUM$ <> ID$ THEN 6535 ELSE INDEX=INDEX-1 : GOTO 6531
6535 CLOSE #4 :OPEN"B:RAWDAT.RAN" AS #4 LEN=50 :RESUME
6540 PRINT #2, "Calculations have been completed ....."
6550 CLOSE #4
6560 PRINT #2, "Place a new FORMATTED DISK IN DRIVE B: and PRESS ANY KEY WHEN RE
ADY"
6570 'DEF SEG=0
6580 'POKE &H417,64 'UNLOCK
6590 AAA$=INKEY$:IF LEN(AAA$)=0 THEN 6590
6600 '
6610 'DEF SEG=0
6620 'POKE &H417,40 'LOCK
6625 PRINT #2, "Please 'PRINT' the last cards data "
6630 RESUME
6700 NEW.FLG=1 : GOTO 82

```

Figure A-2. Takedata.asc

```

7000 OPEN "B:MASTER.FIL" FOR OUTPUT AS #6
7010 INPUT "ENTER TEST NUMBER (1,2,3,...)";TEST.NUM
7020 WRITE #6,TEST.NUM
7030 RETURN
8000 OPEN "B:MASTER.FIL" FOR INPUT AS #6
8010 INPUT #6,TEST.NUM
8020 INPUT #6,LAST.REC
8030 WHILE LAST.REC <> 6250
8040 IF LAST.REC <6250 THEN 8080
8050 LAST.REC=LAST.REC-6250
8060 DISK.NUM=DISK.NUM+1
8070 WEND
8080 PRINT "YOU HAVE ";DISK.NUM;"DISKS FOR THIS TEST PLEASE PLACE THE LAST ON IN
  DRIVE B:"
8090 PRINT "HIT ANY KEY WHEN READY"
8100 J$=INKEY$:IF LEN(J$)=0 THEN 8100
8110 RETURN
9000 CLOSE #4
9005 PRINT "250 CARDS HAVE BEEN WRITTEN TO DISK ... PLACE A NEW FORMATTED DISK I
  N DRIVE B:"
9006 BEEP:BEEP:BEEP:PRINT"PLEASE PRESS ANY KEY WHEN READY AND!!..."
9007 PRINT "PLEASE REPEAT THE LAST CARDS DATA"
9010 J$=INKEY$:IF LEN(J$)=0 THEN 9010
9020 OPEN "B:RAWDAT.RAN" AS #4 LEN = 50
9025 FIELD 4, 10 AS LL$, 10 AS UL$, 10 AS CNT$, 20 AS ID$
9026 'CLOSE #1
9027 'OPEN "COM1:9600,N,8" AS #1
9028 INDEX=1
9030 GOTO 140
9999 CLS
10000 WHILE V<>8191
10010 INPUT #1,DATA.IN$
10012 W=INSTR(DATA.IN$,"DATE")
10014 XX=INSTR(DATA.IN$,"SPECIMEN")
10016 Y=INSTR(DATA.IN$,"LIMITS")
10030 PRINT #2,DATA.IN$
10032 IF W>0 THEN GOSUB 11000
10034 IF XX>0 THEN GOSUB 12000
10036 IF Y>0 THEN GOSUB 13000
10050 V=LOF(1)
10060 WEND
10070 RETURN
11000 DAT$=MID$(DATA.IN$,W+8,9)
11010 YR$=RIGHT$(DAT$,2)
11020 MO$=MID$(DAT$,4,3)
11030 DA$=LEFT$(DAT$,2)
11035 RESTORE 11080
11040 FOR L=1 TO 12
11050 READ MONTH$
11060 IF MO$=MONTH$ THEN MO$=RIGHT$(STR$(L),LEN(STR$(L))-1)
11070 NEXT L
11080 DATA "JAN","FEB","MAR","APR","MAY","JUN","JUL","AUG","SEP","OCT","NOV","DE
  C"
11090 DAT$=MO$+"/"+"DA$+"/"+"YR$

```



```

11100 IF ( (LEN(DAT$) > 8) OR (LEN(DAT$)<6) ) THEN DATE$=DATE$ ELSE DATE$=DAT$
11110 TIME$="8:05:12"
11120 RETURN
12000 SNUM$=MID$(DATA.IN$,XX+11,15)
12010 RETURN
13000 HH=LOF(4)/50:INDEX=HH
13001 IF HH=0 THEN 13009 'STARTING NEW FILE
13002 GET #4, HH
13003 IF LEFT$(ID$,15)=SNUM$ THEN 16000 'DUPLICATE CARD KILLER
13004 GOTO 30000 'IS ID CORRECT?
13005 IF LOF(4) => 312500! THEN 9000 'CARD/DISK LIMIT CURRENTLY 250
13009 WHILE V <> 8191
13010 INDEX=INDEX+1
13020 INPUT #1,DATA.IN$
13030 GOSUB 14000
13035 IF INDEX=10000 THEN 15000
13036 V=LOF(1)
13040 WEND
13050 RETURN
14000 COUNT=1:START=1
14010 K=INSTR(START,DATA.IN$,".")
14020 Z=INSTR(K,DATA.IN$," ")
14030 NLEN=Z-START
14040 NUM$(DEX,COUNT)=MID$(DATA.IN$,START,NLEN)
14050 IF COUNT=3 THEN 14080
14060 COUNT=COUNT+1:START=Z
14070 GOTO 14010
14080 PRINT ABS(VAL(NUM$(DEX,1))),ABS(VAL(NUM$(DEX,2))),ABS(VAL(NUM$(DEX,3))),SN
UM$
14090 NUM$(DEX,2)=STR$(ABS(VAL(NUM$(DEX,2))))
14100 NUM$(DEX,2)=RIGHT$(NUM$(DEX,2),LEN(NUM$(DEX,2))-1)+".00"
14110 LSET ID$=SNUM$
14120 LSET LL$=NUM$(DEX,1)
14130 LSET UL$=NUM$(DEX,2)
14140 LSET CNT$=RIGHT$(NUM$(DEX,3),10)
14150 PUT #4,INDEX
14160 RETURN
15000 '400 CARDS ROUTINE
15010 RETURN
16000 BEEP:BEEP:CLS:PRINT #2, "THIS CARD HAS BEEN READ BEFORE !!!!!"
16010 FOR L=1 TO 2000:NEXT L:RETURN
20000 INDEX=1
20010 OPEN"B:RAWDAT.RAN" AS #1 LEN=50
20020 FIELD 1, 10 AS LL$,10 AS UL$,10 AS CNT$,20 AS ID$
20030 WHILE NOT EOF(1)
20040 GET #1,INDEX
20050 PRINT LL$,UL$,CNT$,ID$
20060 INDEX=INDEX+1
20070 WEND
20080 END
25000 CLOSE :CLS
25010 END
30000 ' COUNT THE NUMBER OF DASHES
30010 GB=1:DASH=0

```

```

30020 WHILE GB<LEN(SNUM$)
30024 IF MID$(SNUM$,GB,1) = "-" THEN DASH = DASH + 1
30026 IF DASH=3 THEN 30069
30030 GB=GB+1
30040 WEND
30041 CLS:BEEP:BEEP
30042 PRINT "PLEASE RE-READ THE CARD AND NOTE THE CORRECT IDENTIFICATION FORMAT
"
30043 PRINT "5-A-110-99"
30044 PRINT "IF THE QMET 900 IS SENDING THIS BAD INFO THEN THIS FILTER WILL STOP
IT FROM BEING WRITTEN TO DISK"
30045 FOR KXK=1 TO 3000:NEXT KXK
30046 RETURN ' TO 10050
30069 GB=GB+1
30070 WHILE GB<LEN(SNUM$)
30080 IF (MID$(SNUM$,GB,1) = "-") OR (MID$(SNUM$,GB,1) = "(") THEN DASH = DASH +
1
30090 IF DASH>3 THEN 30041
30100 GB=GB+1
30120 WEND
30130 GOTO 13005
30140 'IF DASH=3 THEN 13005

```

```

100 LOCATE 3,1:INPUT "PLEASE ENTER THE TEST NUMBER ";TEST.NUM
110 IF TEST.NUM<0 THEN 6000
120 LOCATE 5,1:INPUT "PLEASE ENTER THE PERCENT THICKENER ";THICK
130 IF (THICK<0 ) OR (THICK >=100 ) THEN 6010
140 LOCATE 7,1:INPUT "PLEASE ENTER THE VALUE FOR CONSTANT A ";CONSTA
150 IF CONSTA<0 THEN 6020
160 LOCATE 9,1:INPUT "PLEASE ENTER THE VALUE FOR CONSTANT B ";CONSTB
170 IF CONSTB<0 THEN 6030
180 LOCATE 11,1:INPUT "PLEASE ENTER THE LIQUID DENSITY (Grams/Microns^3) ";LIQDEN
190 IF LIQDEN<0 THEN 6040
200 LOCATE 13,1:INPUT "PLEASE ENTER THE LIQUID TEMPERATURE (Degree C) ";LTEMP
210 IF LTEMP<0 THEN 6050
220 LOCATE 15,1:INPUT "PLEASE ENTER THE NAME OF THE THICKENER ";TNAME$
230 IF TNAME$="" THEN 6060
232 LOCATE 17,1:INPUT "PLEASE ENTER THE NUMBER OF BINS "; TOTAL.BINS
234 IF TOTAL.BINS <=0 THEN 6070
236 LOCATE 19,1:INPUT "PLEASE ENTER THE NUMBER OF DISKS FOR THIS TEST "; TOTAL.D
ISKS
238 IF TOTAL.DISKS <=0 THEN 6080
239 LOCATE 21,1:INPUT "PLEASE ENTER THE SCAN AREA FOR THIS TEST "; SCAN.AREA : I
F SCAN.AREA <= 0 THEN 6090
240 CLS: LOCATE 1,1:INPUT "IS THE TEST DATA CORRECT (yes or no )";ANS
250 IF ANS="N" OR ANS="n" OR ANS="no" OR ANS="NO" THEN CLS :LOCATE 1,60:PRINT "
RE-ENTER DATA ":GOTO 100
260 CLS
270 LOCATE 1,1:PRINT "THE COMPUTER IS NOW READY TO REDUCE THE DATA FOR TEST ";TE
ST.NUM
280 LOCATE 3,1:PRINT "PLACE THE DATA DISK FOR THIS TEST INTO DRIVE B:...."
290 LOCATE 5,1:PRINT "AND PLACE A NEW FORMATTED DISK IN DRIVE A:....."
300 LOCATE 5,1:PRINT "AFTER COMPLETING THE ABOVE PRESS ANY KEY TO CONTINUE"
310 V$=INKEY$:IF LEN(V$)=0 THEN 310
320 CHECK DISK TO SEE IF THIS IS THE CORRECT TEST DISK
330 OPEN "B:MASTER.FIL" FOR OUTPUT AS #1
340 WRITE #1,TEST.NUM,THICK,CONSTA,CONSTB,LIQDEN,LTEMP
350 WRITE #1,TNAME$,TOTAL.BINS,TOTAL.DISKS
360 CLOSE #1
370 CLS:STOP : CHAIN "A:QANALII.RED"
6000 CLS:BEEP:BEEP:LOCATE 3,1:PRINT "THE TEST NUMBER MUST BE GEATER THAN ZERO !!
!"
6001 FOR DD=1 TO 2000:NEXT DD
6002 CLS:GOTO 100
6010 CLS:BEEP:BEEP:LOCATE 5,1:PRINT "THE CHANCES OF 100% THICKENER IS VERY SLIM
AND ITS ALSO SLIM FOR < 0%"
6011 FOR DD=1 TO 4000:NEXT DD
6012 CLS:GOTO 120
6020 CLS:BEEP:BEEP:LOCATE 7,1:PRINT "THE CONSTANT A MUST BE GEATER THAN ZERO !!!
"
6021 FOR DD=1 TO 2000:NEXT DD
6022 CLS:GOTO 140
6030 CLS:BEEP:BEEP:LOCATE 9,1:PRINT "THE CONSTANT B MUST BE GEATER THAN ZERO !!!
"

```

Figure A-3. Frontend.asc

```
6031 FOR DD=1 TO 2000:NEXT DD
6032 CLS:GOTO 160
6040 CLS:BEEP:BEEP:LOCATE 11,1:PRINT "THE LIQUID DENSITY SHOULD BE GEATER THAN Z
ERD !!!"
6041 FOR DD=1 TO 2000:NEXT DD
6042 CLS:GOTO 180
6050 CLS:BEEP:BEEP:LOCATE 13,1:PRINT "THE LIQUID TEMPERATURE SHOULD BE GREATER T
HAN ZERO !!!"
6051 FOR DD=1 TO 2000:NEXT DD
6052 CLS:GOTO 200
6060 CLS:BEEP:BEEP:LOCATE 15,1:PRINT "THE THICKENER SHOULD HAVE A NAME !!!"
6061 FOR DD=1 TO 2000:NEXT DD
6062 CLS:GOTO 220
6070 CLS:BEEP:BEEP:LOCATE 17,1:PRINT "TOTAL BINS SHOULD BE GREATER THAN ZERO"
6071 FOR DD=1 TO 2000 :NEXT DD
6072 CLS:GOTO 232
6080 CLS:BEEP:BEEP:LOCATE 19,1:PRINT "TOTAL DISKS SHOULD BE GREATER THAN ZERO"
6081 FOR DD=1 TO 2000 :NEXT DD
6082 CLS:GOTO 236
6090 CLS:BEEP:BEEP:LOCATE 21,1:PRINT "SCAN AREA SHOULD BE GREATER THAN ZERO"
6091 FOR DD=1 TO 2000 :NEXT DD
6092 CLS:GOTO 236
```

```

65 OPTION BASE 1
75 PI=3.14159 'CONSTANT PI
80 DIM DOTS(25),DOT.SIZE(25),DOT.AREA(25),DOT.MASS(25),MASS(25),DLL(25),DUL(25)
DAV(25),CNT(25),UL(25),LL(25),XXX(100)
85 GOSUB 12000 'ON ERROR GOTO 6000
90 GOTO 7000 'OPEN MASTER.FIL TO GET TEST INFORMATION
110 'OPEN RAWDAT.RAN ( THE RANDOM DATA FILE AND START REDUCTION)
120 'START WITH THE FIRST DATA DISK
130 OPEN "C:RAWDAT.RAN" AS #1 LEN=50
140 FIELD 1, 10 AS LL$,10 AS UL$,10 AS CNT$,20 AS ID$
141 'OPEN A FILE ON DRIVE A: TO SAVE UNSORTED REDUCED DATA
142 OPEN "C:"+ "CARD"+RIGHT$(STR$(TEST.NUM),LEN(STR$(TEST.NUM))-1)+".RAN" AS #2
EN=255
143 FIELD #2,20 AS INUM$,125 AS SIZCAT$,10 AS SUM$,10 AS PAREA$,10 AS MMD$,10 A
NMD$,10 AS MD$,10 AS ND$,10 AS SIGMA$,10 AS DROP$,10 AS LITER$,10 AS GAL$,10 A
GRAM$
145 INDEX=1 : TOTAL.CARDS = 0 : CREC = 1 :DISK.COUNT = 1
150 WHILE NOT EOF(1)
155 AX=1
215 WHILE AX < TOTAL.BINS + 1
220 GET #1,INDEX
225 IF EOF(1) THEN 270 '***** CHECK FOR BLANK RECORD *****
230 GOSUB 1000 'ASSIGN VALUES
240 INDEX=INDEX+1
250 WEND
255 TOTAL.CARDS = TOTAL.CARDS + 1
257 GOSUB 10000 'CHECK ID NUMBERS
260 GOSUB 2000 'OPERATE ON DATA
261 GOSUB 2300 'COMPUTE NUMBER MEAN,MEDIAN
265 GOSUB 4000 'LOTS OF CALCULATIONS
266 PRINT "TEST.TOTAL.MASS= ";TEST.TOTAL.MASS
267 PRINT "NUMBER MEDIAN DIAMETER= ";NMD.50
268 'STOP
270 WEND
271 GOSUB 5000 'CHECK FOR NEXT DATA DISK
275 GOSUB 4200 'CALCULATE OVERALL TEST MMD AND SIGMA
276 GOSUB 9000 'CALCULATE SIZE CATEGORY DATA
277 GOSUB 9500 'CALCULATE OVERALL TEST DATA
280 GOSUB 3000 'CLEAN UP OUTPUT ROUTINES DISK ,PRINTER,SCREEN
290 END 'END MAIN
1000 'ASSIGNMENTS
1010 IDENT$=ID$
1020 LOWER$=LL$
1030 UPPER$=UL$
1040 COUNT$=CNT$
1045 'PRINT IDENT$,LOWER$,UPPER$,COUNT$
1050 ' CONVERT DATA AND STORE IN ARRAY
1060 LL=VAL(LOWER$)
1070 UL=VAL(UPPER$)
1080 CNT=VAL(COUNT$)
1085 'PRINT LL,UL,CNT,
1086 'STOP
1090 LL(AX)=LL

```

Figure A-4. Qreduct.asc

```

1100 UL(AX)=UL
1105 IF UL(1)<> 440 THEN BEEP:BEEP:BEEP:PRINT "DATA OVER LAP !!!!!":STOP
1106 *STOP
1110 CNT(AX)=CNT
1120 AX=AX+1
1130 RETURN
2000 *DATA CALCULATIONS
2005 IF LL(1)=0 THEN LL(1)=1 *EXECPTION TO EVERY RULE.QMET LOWER LIMIT IF ZERO
MUST BE SET TO ONE FOR LOG NORMAL DISTRIBUTION IN LINE 2040
2010 FOR KX=1 TO TOTAL.BINS
2020     DLL(KX)=CONSTA*LL(KX)^CONSTB
2030     DUL(KX)=CONSTA*UL(KX)^CONSTB
2040     DAV(KX)=EXP(.5*LOG(DLL(KX)*DUL(KX)))
2050     MASS(KX)=1.3333333#PI*(DAV(KX)/2)^3*LIQDEN*CNT(KX)
2060 NEXT KX
2065 *PRINT "MASS(25)=";MASS(25);" DAV(25)=";DAV(25)
2066 *STOP
2070 * FIND TOTAL MASS
2080 FOR KX=1 TO TOTAL.BINS
2090     TOTAL.MASS=TOTAL.MASS+MASS(KX)
2100 NEXT KX
2105 PRINT "TOTAL.MASS=";TOTAL.MASS
2106 *STOP
2110 *
2120 FOR KX=1 TO TOTAL.BINS
2130     SUM.MASS=SUM.MASS+MASS(KX)
2135 *PRINT "FOR MMD.50 SUM.MASS=";SUM.MASS
2136 *STOP
2140     IF SUM.MASS/TOTAL.MASS >=.5 THEN 2500
2145     LST=SUM.MASS/TOTAL.MASS
2150 NEXT KX
2155 SUM.MASS=0 *RE-INITIALIZE
2160 *CALCULATE SIGMA
2170 FOR KX=1 TO TOTAL.BINS
2180     SUM.MASS=SUM.MASS+MASS(KX)
2185 *PRINT "FOR MMD.84 SUM.MASS=";SUM.MASS
2186 *STOP
2190     IF SUM.MASS/TOTAL.MASS>=.84 THEN 2600
2195     LST=SUM.MASS/TOTAL.MASS
2197 NEXT KX
2198 BEEP:BEEP:PRINT "SKIPPED 2600"
2199 CARD.DOT.AREA = 0 *RE-INITIALIZE
2200 SIGMA=MMD.84/MMD.50 *SIGMA FOR EACH CARD
2205 PRINT "SIGMA=";SIGMA;" MMD.50=";MMD.50
2206 *STOP
2210 FOR KX=1 TO TOTAL.BINS
2220 CARD.COUNT=CARD.COUNT+CNT(KX)
2230 NEXT KX *TOTAL DOTS/CARD
2240 FOR KX=1 TO TOTAL.BINS
2250 CARD.DOT.AREA=CARD.DOT.AREA+PI*((UL(KX)+LL(KX))/4)^2*CNT(KX)
2260 NEXT KX *AREA COVERED BY DOTS IN MICRONS SQUARED
2265 PRINT "CARD.DOT.AREA= ";CARD.DOT.AREA
2266 *STOP
2270 RETURN ****** STOPPED HERE *****

```

```

2300 '*****
2310 '***** NUMBER MEAN & MEDIAN CALCULATIONS *****
2320 '*****
2330 '
2331 FOR KX =1 TO TOTAL.BINS
2332 TC = TC +CNT(KX)
2333 NEXT KX
2334 PRINT TC
2340 FOR KX = 1 TO TOTAL.BINS
2350 IC = IC + CNT(KX)
2360 IF IC/TC >= .5 THEN 2700
2365 LST = IC/TC
2370 NEXT KX
2375 GOSUB 2400 'MEAN CALCULATION
2380 RETURN
2400 '*****
2410 '***** MEAN *****
2420 '*****841101*****
2430 '
2440 FOR KX = 1 TO TOTAL.BINS
2450 NM = NM + CNT(KX)*DAV(KX)
2460 NEXT KX
2470 ND = NM/TC
2480 RETURN
2500 'PRINT "ENTERING 2500 CALC MMD.50";"KX= ";KX 'MMD.50 INTERPOLATION
2501 UST=SUM.MASS/TOTAL.MASS
2502 'PRINT "UST= ";UST
2505 IF UST >.5 THEN 2530
2510 MMD.50=DAV(KX) 'MMD.50 FOR A CARD
2520 GOTO 2155
2530 UK=KX : IF UK = 1 THEN LK=1 :GOTO 2550
2540 LK=KX-1
2550 MMD.UL=DAV(UK)*UST*2
2560 MMD.LL=DAV(LK)*LST*2
2570 MMD.GM=(DAV(UK)+DAV(LK))* .5
2580 MMD.50=MMD.GM 'MMD.50 FOR A CARD
2585 IF MMD.50<=0 THEN BEEP:BEEP:BEEP:PRINT "MMD.50 <= 0 !!!! STOP!!!!":STOP
2590 GOTO 2155
2600 'PRINT "ENTERING 2600 CALC MMD.84";"KX= ";KX'MMD.84 INTERPOLATION
2601 UST=SUM.MASS/TOTAL.MASS
2602 'PRINT "UST= ";UST
2605 IF UST>.84 THEN 2630
2610 MMD.84=DAV(KX) 'MMD.84 FOR A CARD
2620 GOTO 2200
2630 UK=KX : IF UK=1 THEN LK = 1 : GOTO 2650
2640 LK=KX-1
2650 MMD.UL=DAV(UK)*UST*2
2660 MMD.LL=DAV(LK)*LST*2
2670 MMD.GM=(DAV(UK)+DAV(LK))* .5
2680 MMD.84=MMD.GM 'MMD.84 FOR A CARD
2690 GOTO 2200
2700 '*****
2710 '***** INTERPOLATE MEAN & MEDIAN *****
2720 '*****

```

```

2730 '
2740 UST = IC/TC
2750 '
2760 IF UST>.5 THEN 2790
2770 NMD.50 = DAV(KX) 'NMD.50 FOR A CARD
2780 GOTO 2380
2790 UK=KX : IF UK = 1 THEN LK = 1 : GOTO 2810
2800 LK = KX - 1
2810 NMD.GM = (DAV(UK) + DAV(LK) )*.5
2820 NMD.50 = NMD.GM 'NMD.50 FOR A CARD
2830 IF NMD.50 <=0 THEN BEEP:BEEP:BEEP:PRINT "NMD.50 <=0"
2840 GOTO 2380
3000 CLS: PRINT "HELLO WE JUST FINISHED A DISK "
3010 RETURN
4000 'LOTS OF CALCULATIONS
4010 '
4011 '
4012 '
4020 TEST.TOTAL.MASS=TEST.TOTAL.MASS+TOTAL.MASS
4025 'PRINT "TEST.TOTAL.MASS= ";TEST.TOTAL.MASS
4030 TEST.TOTAL.COUNT=TEST.TOTAL.COUNT+CARD.COUNT
4040 FOR KX=1 TO TOTAL.BINS
4050 DOTS(KX)=DOTS(KX)+CNT(KX)
4060 NEXT KX 'SUM DOTS IN EACH IN EACH SIZE CLASS
4070 FOR KX=1 TO TOTAL.BINS
4080 DOT.SIZE(KX)=DAV(KX)
4090 NEXT KX 'SAVE DOT SIZES/BY SIZE CLASS
4100 FOR KX=1 TO TOTAL.BINS
4110 DOT.MASS(KX)=DOT.MASS(KX)+MASS(KX)
4120 NEXT KX 'SAVE DOT MASSES/BY SIZE CLASSES
4130 TEST.TOTAL.AREA=TEST.TOTAL.AREA+CARD.DOT.AREA
4140 FOR KX=1 TO TOTAL.BINS
4150 DOT.AREA(KX)=DOT.AREA(KX)+PI*((UL(KX)+LL(KX))/4)^2*CNT(KX)
4160 NEXT KX 'SAVE DOT AREAS/ BY SIZE CLASS
4161 GRAMS.PER.SQCM = TOTAL.MASS/SCAN.AREA
4162 GRAMS.PER.SQM = GRAMS.PER.SQCM * 10000
4163 GRAMS.PER.HECTARE = GRAMS.PER.SQM * 10000
4164 LITERS.PER.HECTARE = (GRAMS.PER.HECTARE/(LQDEN*(10000!)^3))/1000
4165 GAL.PER.ACRE = (LITERS.PER.HECTARE * .000264)/2.47
4166 DROPS.PER.SQCM = CARD.COUNT/SCAN.AREA
4180 CCARD.DOT.AREA=(CARD.DOT.AREA/2.112E+09)*100
4190 GOSUB 8000 'WRITE CARD DATA *****
4197 MMD.50=0:SIGMA=0:TOTAL.MASS=0:CARD.DOT.AREA=0:CARD.COUNT=0
4198 TOTAL.MASS=0:CARD.DOT.AREA=0:SUM.MASS=0
4199 FOR KX=1 TO TOTAL.BINS:MASS(KX)=0:NEXT KX:RETURN
4200 '*****
4205 '***** MMD.50 & SIGMA CALCULATIONS *****
4206 '***** FOR THE ENTIRE TEST *****
4210 '*****
4220 FOR KX=1 TO TOTAL.BINS
4230 TOTAL.SUM.MASS=TOTAL.SUM.MASS+DOT.MASS(KX)
4235 'PRINT "FOR MMD.50 SUM.MASS=";SUM.MASS
4236 'STOP
4240 IF TOTAL.SUM.MASS/TEST.TOTAL.MASS >=.5 THEN 4500

```



```

4245     LST=TOTAL.SUM.MASS/TEST.TOTAL.MASS
4250 NEXT KX
4255 TOTAL.SUM.MASS=0 'RE-INITIALIZE
4260 'CALCULATE SIGMA
4270 FOR KX=1 TO TOTAL.BINS
4280     TOTAL.SUM.MASS=TOTAL.SUM.MASS+DOT.MASS(KX)
4285 'PRINT "FOR MMD.84 SUM.MASS=";SUM.MASS
4286 'STOP
4290     IF TOTAL.SUM.MASS/TEST.TOTAL.MASS>=.84 THEN 4600
4295     LST=TOTAL.SUM.MASS/TEST.TOTAL.MASS
4297 NEXT KX
4298 BEEP:BEEP:PRINT "SKIPPED 4600"
4299 'SUM.MASS=0 'RE-INITIALIZE
4300 TEST.SIGMA=TEST.MMD.84/TEST.MMD.50 'SIGMA FOR EACH CARD
4305 PRINT "TEST.SIGMA=";TEST.SIGMA;" TEST.MMD.50=";TEST.MMD.50
4306 'STOP
4370 RETURN '***** STOPPED HERE *****
4500 'PRINT "ENTERING 4500 CALC TEST.MMD.50";"KX=";KX 'TEST.MMD.50 INTERPOLAT
ON
4501     UST=TOTAL.SUM.MASS/TEST.TOTAL.MASS
4502 'PRINT "UST=";UST
4505     IF UST >.5 THEN 4530
4510     TEST.MMD.50=DOTS(KX) 'TEST.MMD.50 FOR THE ENTIRE TEST
4520 GOTO 4155
4530     UK=KX : IF UK = 1 THEN LK=1 :GOTO 4550
4540     LK=KX-1
4550     MMD.UL=DAV(UK)*UST*2
4560     MMD.LL=DAV(LK)*LST*2
4570     TEST.MMD.GM=(DAV(UK)+DAV(LK))*0.5
4580     TEST.MMD.50=TEST.MMD.GM 'TEST.MMD.50 FOR THE ENTIRE TEST
4585 IF TEST.MMD.50<=0 THEN BEEP:BEEP:BEEP:PRINT "TEST.MMD.50 <= 0 !!! STOP!!!"
":STOP
4590 GOTO 4255
4600 'PRINT "ENTERING 4600 CALC TEST.MMD.84";"KX=";KX 'TEST.MMD.84 INTERPOLATIO
ON
4601     UST=TOTAL.SUM.MASS/TEST.TOTAL.MASS
4602 'PRINT "UST=";UST
4605     IF UST>.84 THEN 4630
4610     TEST.MMD.84=DOTS(KX) 'TEST.MMD.84 FOR THE ENTIRE TEST
4620 GOTO 4200
4630     UK=KX : IF UK=1 THEN LK = 1 : GOTO 4650
4640     LK=KX-1
4650     MMD.UL=DAV(UK)*UST*2
4660     MMD.LL=DAV(LK)*LST*2
4670     TEST.MMD.GM=(DAV(UK)+DAV(LK))*0.5
4680     TEST.MMD.84=TEST.MMD.GM 'TEST.MMD.84 FOR THE ENTIRE TEST
4690 GOTO 4299
4700 '*****
4701 '***** TEST NUMBER MEAN , MEDIAN *****
4702 '*****
4703 '
4710 FOR KX =1 TO TOTAL.BINS
4720 TEST.TC = TEST.TC + DOTS(KX)
4730 NEXT KX

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4740 FOR KX = 1 TO TOTAL.BINS
4750 TEST.IC = TEST.IC + DOTS(KX)
4760 IF TEST.IC/TEST.TC >.5 THEN 4900
4770 UST = TEST.IC/TEST.TC
4780 GOSUB 4800 'TEST NUMBER MEAN CALCULATION
4790 RETURN
4900 '*****
4910 '***** INTERPOLATE TEST MEAN & MEDIAN *****
4920 '*****
4930 '
4940 UST = IC/TC
4950 '
4960 IF UST>.5 THEN 4990
4970 TEST.NMD.50 = DAV(KX) 'NMD.50 FOR A CARD
4980 GOTO 4790
4990 UK=KX : IF UK = 1 THEN LK = 1 : GOTO 4992
4991 LK = KX - 1
4992 NMD.GM = (DAV(UK) + DAV(LK) )*.5
4993 TEST.NMD.50 = NMD.GM 'NMD.50 FOR A TEST
4994 IF TEST.NMD.50 <=0 THEN BEEP:BEEP:BEEP:PRINT "TEST.NMD.50 <=0"
4995 GOTO 4790
5000 DISK.COUNT= 2 ' CHECK MASTER FILE PARAMETERS
5010 IF DISK.COUNT > TOTAL.DISKS THEN CLOSE #2:RETURN 'FINISH UP PROGRAM
5020 CLS:LOCATE 1,1:BEEP:BEEP: PRINT "PLEASE PLACE THE NEXT DATA DISK IN DRIVE
:"
5030 PRINT "PRESS ANY KEY WHEN READY....."
5040 J$=INKEY$:IF LEN(J$)=0 THEN 5040
5050 RETURN 110 'OPEN NEXT DATA FILE ON DRIVE B:
6000 IF ERR=53 THEN 6100
6100 CLS:LOCATE 1,1:PRINT "THE MASTER.FIL IS NOT IN DRIVE B: ..."
6110 LOCATE 2,1:PRINT "RESTART ANALYSIS PROGRAM AND CREATE MASTER.FIL"
6120 FOR DD=1 TO 4000:NEXT DD:END:SYSTEM
7000 ' OPEN MASTER.FIL
7001 ' TEST.NUM TEST NUMBER
7002 ' THICK PERCENT THICKENER
7003 ' CONSTA CONSTANT A IN THE SPREAD FACTOR EQUATION
7004 ' CONSTB CONSTANT B IN THE SPREAD FACTOR EQUATION
7005 ' SPREAD FACTOR EQUATION.....
7006 ' DROP.DIAMETER = CONSTA * STAIN.DIAMETER ^ CONSTB
7007 ' LIODEN LIQUID DENSITY (GRAMS/CUBIC MICRONS)
7008 ' LTEMP LIQUID TEMPERATURE
7009 ' TNAME$ THICKENER NAME
7010 ' TOTAL.BINS NUMBER OF SIZE CATAGORIES USED ON THE IMAGE ANALYZER
7011 ' TOTAL.DISKS NUMBER OF DISKS USED TO RECORD THE TEST DATA
7012 ' SCAN.AREA THE AREA READ BY THE IMAGE ANALYZER (SQ. CM.)
7019 OPEN "B:MASTER.FIL" FOR INPUT AS #1
7020 INPUT #1,TEST.NUM,THICK,CONSTA,CONSTB,LIODEN,LTEMP
7030 INPUT #1,TNAME$,TOTAL.BINS,TOTAL.DISKS,SCAN.AREA
7040 CLOSE #1
7050 GOTO 110 'GOTO TOP AND OPEN RAWDATA.RAN FOR DATA REDUCTION
7500 '***** MODIFY ID NUMBER *****
7510 GB=1:DASH=1
7520 WHILE GB= LEN(IDENT$)
7530 IF MID$(IDENT$,GB,1)="-" THEN DASH=DASH+1

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7540 IF DASH=3 THEN 7640
7550 GB=GB+1
7560 WEND
7565 IF DASH = 2 THEN PRINT "M":BEEP:GOSUB 10000 : GOTO 7640 'MODIFY ID WITH 2
ASHES
7570 CLS:BEEP:BEEP
7580 LOCATE 1,1:PRINT "THE CARD IDENTIFICATION NUMBER IS IN ERROR ...."
7590 LOCATE 2,1:PRINT "THE PREVIOUS NUMBER WAS ";PREVIOUS.ID$;" ....."
7600 LOCATE 3,1:PRINT "PLEASE CHANGE ID NUMBER TO CORRECT FORMAT...."
7610 LOCATE 4,1:INPUT "CHANGE NUMBER (C) OR LEAVE ALONE (L)";AN$
7620 IF AN$="C" OR AN$="c" THEN 7700
7630 PREVIOUS.ID$=IDENT$ : RETURN 'SAVE PREVIOUS ID NUMBER
7640 GB=GB+1
7650 WHILE GB<LEN(IDENT$)
7660 IF (MID$(IDENT$,GB,1)="-") OR (MID$(IDENT$,GB,1)="(") THEN DASH=DASH+1
7670 IF DASH>3 THEN 7570
7675 IF DASH = 3 THEN 7710
7680 GB=GB+1
7690 WEND
7700 LOCATE 5,1:INPUT "ENTER ID NUMBER ";IDENT$
7710 PREVIOUS.ID$=IDENT$ 'SAVE PREVIOUS ID NUMBER
7720 RETURN
8000 '*****
8010 '***** WRITE CARD DATA *****
8020 '*****
8030 '
8040 ' WRITTING THE FOLLOWING DATA:          FIELD DESCRIPTORS  FIELD LENGHT
8050 ' CARD IDENTIFICATION NUMBER          INUM$              20
8060 ' COUNTS FOR EACH SIZE CATEGORY        SIZCAT$            125
8070 ' TOTAL DOTS PER CARD                  SUM$              10
8080 ' PERCENT AREA OF COVERAGE BY THE DOTS PAREA$            10
8090 ' MASS MEDIAN DIAMETER FOR THE CARD    MMD$              10
8091 ' MASS MEAN DIAMETER FOR THE CARD      MD$              10
8092 ' NUMBER MEDIAN DIAMETER FOR THE CARD  NMD$              10
8093 ' NUMBER MEAN DIAMETER FOR THE CARD    ND$              10
8100 ' SIGMA FOR THE CARD                   SIGMA$            10
8110 ' DROPS PER SQUARE CENTIMETER         DROP$            10
8120 ' LITERS PER HECTARE                   LITER$           10
8130 ' GALLONS PER ACRE                     GAL$            10
8140 ' GRAMS PER SQUARE METER              GRAM$            10
8150 '
8160 '*****
8170 '***** CREATE SIZCAT$ *****
8180 '*****
8190 '
8200 CARD.COUNTS$ = ""
8210 FOR KX=1 TO TOTAL.BINS
8220 BC$ = STR$(CNT(KX))
8230 LCNT = LEN(BC$)
8240 BC$ = RIGHT$(BC$,LCNT-1)
8250 IF LEN(BC$) < 5 THEN BC$ = BC$ + " " : GOTO 8250 '** MAKE STRINGS SAME LEN
HTS
8260 CARD.COUNTS$ = CARD.COUNTS$ + BC$
8270 NEXT KX

```

```

8271 MD = EXP(LOG(MMD.50)+.5*(LOG(SIGMA)^2))
8280 ?
8290 ?*****
8300 ?***** ASSIGN VARIABLES *****
8310 ?***** TO *****
8320 ?***** FIELDS *****
8330 ?*****
8340 LSET INUM$ = IDENT$ ? :PRINT IDENT$
8350 LSET SIZCAT$ = CARD.COUNTS$ ? :PRINT CARD.COUNTS$
8360 LSET SUM$ = MKS$(CARD.COUNT) ? :PRINT CARD.COUNT
8370 LSET PAREA$ = MKS$(CCARD.DOT.AREA) ? : PRINT CCARD.DOT.AREA
8380 LSET MMD$ = MKS$(MMD.50) ? : PRINT MMD.50
8381 LSET MD$ = MKS$(MD)
8382 LSET NMD$ = MKS$(NMD.50)
8383 LSET ND$ = MKS$(ND)
8390 LSET SIGMA$ = MKS$(SIGMA) ? : PRINT SIGMA
8400 LSET DROP$ = MKS$(DROPS.PER.SQCM) ? :PRINT DROPS.PER.SQCM
8410 LSET LITER$ = MKS$(LITERS.PER.HECTARE) ? : PRINT LITERS.PER.HECTARE
8420 LSET GAL$ = MKS$(GAL.PER.ACRE) ? : PRINT GAL.PER.ACRE
8430 LSET GRAM$ = MKS$(GRAMS.PER.SQM) ? : PRINT GRAMS.PER.SQM
8440 ?***** CALCULATE OVERALL TEST PARAMETERS *****
8441 ?
8442 TEST.DROPS.PER.SQCM = TEST.DROPS.PER.SQCM + DROPS.PER.SQCM
8443 TEST.LITERS.PER.HECTARE = TEST.LITERS.PER.HECTARE + LITERS.PER.HECTARE
8444 TEST.GAL.PER.ACRE = TEST.GAL.PER.ACRE + GAL.PER.ACRE
8445 TEST.GRAMS.PER.SQM = TEST.GRAMS.PER.SQM + GRAMS.PER.SQM
8446 ?
8450 ?*****
8460 ?***** WRITE FIELD DATA *****
8470 ?***** TO *****
8480 ?***** DRIVE A: *****
8490 ?*****
8500 ?
8510 PUT #2,CREC ?***** WRITE A COMPOSITE DATA RECORD *****
8515 CREC = CREC + 1
8516 IF CREC > 1000 THEN BEEP: PRINT "DISK IN DRIVE A: IS FULL ";CHR$(13);"PLACI
  A NEW DISK IN DRIVE A:" ELSE 8518
8517 CLOSE #2:
8518 TC = 0:NM = 0
8519 ?PRINT "SIZCAT$= ";SIZCAT$,"CARD.COUNT$= ";CARD.COUNTS$
8520 RETURN
9000 ?*****
9010 ?***** WRITE SIZE CATEGORY DATA *****
9020 ?*****
9030 ?
9040 ? WRITTING THE FOLLOWING DATA: FIELD DESCRIPTORS FIELD LENGTH
9050 ? SIZE CATEGORY CAT$ 10
9060 ? UPPER LIMIT STAIN DIAMETER SUPL$ 10
9070 ? LOWER LIMIT STAIN DIAMETER SLWL$ 10
9080 ? AERITHMATIC AVERAGE STAIN DIAMETER SAV$ 10
9090 ? UPPER LIMIT DROP DIAMETER DUPL$ 10
9100 ? LOWER LIMIT DROP DIAMETER DLWL$ 10
9110 ? LOG NORMAL AVERAGE DROP DIAMETER DAV$ 10
9120 ? MASS OF A DROP GM/(MICRON)^3 MAVD$ 20

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9121 'COUNTS IN CATEGORY DROPS/SQ CM          DPSQCM$          10
9122 'MASS RECOVERED GM/SQ M                    MAREC$          10
9123 'CUMMULATIVE MASS GRAMS                    CUM$            10
9124 'PERCENT MASS IN CATEGORY                  FMCAT$          10
9125 'CUMMULATIVE MASS PERCENT IN CATEGORY CPMCAT$          10
9130 '
9140 '*****
9150 '*****
9160 '***** ASSIGN VARIABLES *****
9170 '***** TO *****
9180 '***** FIELDS *****
9190 '*****
9191 CLOSE #1:OPEN "C:"+ "SIZE"+TEST.NUM$+".RAN" AS #1 LEN = 140
9192 FIELD #1, 10 AS CAT$,10 AS SUPL$,10 AS SLWL$,10 AS SAV$,10 AS DUPL$,10 AS
LWL$,10 AS DAV$,20 AS MAVD$,10 AS DPSQCM$,10 AS MAREC$,10 AS CUM$,10 AS FMCAT$,
0 AS CPMCAT$
9200 FOR KX =1 TO TOTAL.BINS
9210 LSET CAT$ = MKS$(KX) :PRINT "SIZE= ";KX
9220 LSET SUPL$ = MKS$(UL(KX)) : PRINT "UL= ";UL(KX)
9230 LSET SLWL$ = MKS$(LL(KX)) : PRINT "LL= ";LL(KX)
9240 LSET SAV$ = MKS$((UL(KX)+LL(KX))/2) : PRINT "AV DROP= "; (UL(KX)+LL(KX))/2
9250 LSET DUPL$ = MKS$(DUL(KX)) : PRINT "DUL ="; DUL(KX)
9260 LSET DLWL$ = MKS$(DLL(KX)): PRINT "DLL ="; DLL(KX)
9270 LSET DAV$ = MKS$(DAV(KX)) : PRINT "DAV ="; DAV(KX)
9280 LSET MAVD$ = MKS$(4/3*(DAV(KX)/2)^3*PI*LIQDEN) : PRINT CVS(MAVD$)
9281 DPSCM.PER.CAT = DOTS(KX)/(21.12*TOTAL.BINS)
9282 LSET DPSQCM$ = MKS$(DPSCM.PER.CAT):PRINT CVS(DPSQCM$)
9283 GMSQM.PER.CAT = (DOTS(KX)*(4/3)*PI*(DAV(KX)/2)^3*LIQDEN)/((21.12/(100)^2)*
OTAL.BINS)
9284 LSET MAREC$ = MKS$(GMSQM.PER.CAT):PRINT CVS(MAREC$)
9285 CUM.MASS.PER.CAT =CUM.MASS.PER.CAT + ((DAV(KX)/2)^3*LIQDEN*PI*4/3)*DOTS(KX
9286 LSET CUM$ = MKS$(CUM.MASS.PER.CAT):PRINT CVS(CUM$)
9287 PER.MASS.CAT = (((DAV(KX)/2)^3*LIQDEN*PI*4/3)*DOTS(KX))/TEST.TOTAL.MASS)*
00
9288 LSET PMCAT$ = MKS$(PER.MASS.CAT):PRINT CVS(PMCAT$)
9289 CUM.PER.MASS.CAT = CUM.PER.MASS.CAT + PER.MASS.CAT : LSET CPMCAT$ = MKS$(C
M.PER.MASS.CAT):PRINT CVS(CPMCAT$)
9290 PUT #1,KX '***** WRITE DATA TO DRIVE A:*****
9300 NEXT KX
9310 '
9320 CLOSE #1
9330 RETURN
9500 '*****
9510 '***** WRITE OVERALL TEST DATA *****
9520 '*****
9530 '
9540 ' WRITTING THE FOLLOWING DATA;          FIELD DESCRIPTORS  FIELD LENGTH
9550 ' OVERALL TEST MASS MEDIAN DIAMETER      TMMD$              10
9551 ' OVERALL TEST NUMBER MEDIAN DIAMETER    TNMD$              10
9552 ' OVERALL TEST MASS MEAN DIAMETER        TMD$               10
9553 ' OVERALL TEST NUMBER MEAN DIAMETER      TND$               10
9560 ' OVERALL TEST SIGMA                    TSIGMA$            10
9570 ' OVERALL TEST DROPS/SQ CENTIMETER      TDPSCM$           10

```

```

9580 ' OVERALL TEST LITERS/HECTARE          TLPH$          10
9590 ' OVERALL TEST GALLONS/ACRE           TGFA$          10
9600 ' OVERALL TEST GRAMS/SQ METER         TGPSM$          10
9610 ' *****
9620 ' *****
9630 ' ***** ASSIGN VARIABLES *****
9640 ' ***** TO *****
9650 ' ***** FIELDS *****
9660 ' *****
9670 OPEN "C:"+"OVER"+TEST.NUM$+".RAN" AS #1 LEN = 90
9680 FIELD #1, 10 AS TMMD$,10 AS TNMD$,10 AS TMD$,10 AS TND$,10 AS TSIGMA$,10 AS
TDPSCM$,10 AS TLPH$,10 AS TGFA$,10 AS TGPSM$
9690 LSET TMMD$ = MKS$(TEST.MMD,50)
9691 LSET TNMD$ = MKS$(TEST.NMD,50)
9692 LSET TMD$ = MKS$(TEST.MD,50)
9693 LSET TND$ = MKS$(TEST.ND,50)
9700 LSET TSIGMA$ = MKS$(TEST.SIGMA)
9710 LSET TDPSCM$ = MKS$(TEST.DROPS.PER.SQCM/TOTAL.CARDS)
9720 LSET TLPH$ = MKS$(TEST.LITERS.PER.HECTARE/TOTAL.CARDS)
9730 LSET TGFA$ = MKS$(TEST.GAL.PER.ACRE/TOTAL.CARDS)
9740 LSET TGPSM$ = MKS$(TEST.GRAMS.PER.SQM/TOTAL.CARDS)
9750 '
9760 ' *****
9770 ' ***** WRITE RECORD TO DISK *****
9780 ' ***** DRIVE A: *****
9790 ' *****
9800 '
9810 PUT #1,1
9820 CLOSE #1
9830 RETURN
10000 ' ***** MODIFIY IDENTIFICATION NUMBER *****
10005 IDENT$ = ID$
10010 ' IF LEN(IDENT$)<>20 THEN BEEP:BEEP :STOP
10020 V=1:Y=0:AX=1
10030 Y=INSTR(V,IDENT$,"-")
10040 IF Y<>0 THEN XXX(AX)=Y:V=Y+1:AX=AX+1:GOTO 10030
10050 'PRINT XXX(1),XXX(2),XXX(3)
10060 ALPHA=XXX(1)
10070 BETA=XXX(2)
10080 GAMMA=XXX(3)
10090 IF AX>4 THEN PRINT "ERROR MORE THAN 3 -":STOP
10100 IF AX<4 THEN 10200
10110 TEST.NUM$=LEFT$(IDENT$,ALPHA-1)
10120 ZONE$=MID$(IDENT$,ALPHA+1,BETA-ALPHA-1)
10130 RANGE=VAL(MID$(IDENT$,BETA+1,GAMMA-BETA-1))
10140 ANGLE=VAL(MID$(IDENT$,GAMMA+1,(LEN(IDENT$)-(GAMMA+1))))
10150 'PRINT "TEST.NUM=";TEST.NUM
10160 'PRINT "ZONE=";ZONE$
10170 'PRINT "RANGE=";RANGE
10180 'PRINT "ANGLE=";ANGLE
10190 GOSUB 10290 : RETURN ' MODIFIY RANGE AND ANGLE
10200 PART1$=LEFT$(IDENT$,ALPHA-1)
10210 PART2$=RIGHT$(IDENT$,LEN(IDENT$)-ALPHA)
10220 PART1=VAL(PART1$)

```

```

10230 B$=RIGHT$(STR$(PART1),LEN(STR$(PART1))-1)
10240 BL=LEN(B$)
10250 PART3$=RIGHT$(PART1$,LEN(PART1$)-BL)
10260 IDENT$=B$+"-"+PART3$+"-"+PART2$
10270 'PRINT IDENT$
10280 GOTO 10010
10290 '***** MODIFIY RANGE AND ANGLE *****
10300 RANGE$ = STR$(RANGE)
10310 RL= LEN(RANGE$)
10320 RANGE$=RIGHT$(RANGE$,RL-1)
10330 RL=RL-1
10340 IF RL=2 THEN RANGE$="0"+RANGE$
10350 IF RL=1 THEN RANGE$="00"+RANGE$
10360 ANGLE$ = STR$(ANGLE)
10370 AL= LEN(ANGLE$)
10380 ANGLE$=RIGHT$(ANGLE$,AL-1)
10390 AL=AL-1
10400 IF AL=1 THEN ANGLE$="00"+ANGLE$
10410 IF AL=2 THEN ANGLE$="0"+ANGLE$
10420 'PRINT "ANGLE= ";ANGLE$
10430 'PRINT "RANGE= ";RANGE$
10440 IDENT$ = TEST.NUM$+"-"+ZONE$+"-"+RANGE$+"-"+ANGLE$
10450 RETURN
12000 '*****
12010 '***** SCREEN ROUTINE *****
12020 '*****
12030 LOCATE 1,1:PRINT "QUANTIMET 900 IMAGE ANALYSIS SOFTWARE version 2.0"
12040 LOCATE 2,1:PRINT "COPYWRITE (c) 1984 BRUCE ALLEN SOFTWARE"
12050 LOCATE 3,1:PRINT "ALL RIGHTS RESERVED"
12060 FOR L=1 TO 10000:NEXT L:CLS:RETURN

```

Blank


```

90 'INTCGE$ = "F"
100 OPEN"C:CARDS.RAN" AS #1 LEN=255
110 FIELD #1, 20 AS ID$,125 AS SIZCAT$,10 AS SUM$,10 AS PAREA$,10 AS MMD$,10 AS
NMD$,10 AS MD$,10 AS ND$,10 AS SIGMA$,10 AS DROP$,10 AS LITER$,10 AS GAL$,10 AS
GRAM$
120 INDEX=1:NXT=1:TOP=1
125 'GOTO 370
130 BOTTOM=LOF(1)/225
140 LAST.REC=BOTTOM
150 TOTAL.REC=BOTTOM
160 GET #1,INDEX
165 GOSUB 1000 '***** GET INFO TO SWAP ***** IDENT1$=ID$
170 INDEX=INDEX+1
180 NXT=INDEX
195 PRINT BOTTOM
200 WHILE TOP <> INT(TOTAL.REC+1)
210 WHILE INDEX <> INT(LAST.REC+1)
220 GET #1,NXT
230 GOSUB 2000 '***** GET INFO TO SWAP ***** IDENT2$=ID$
231 COMP2$=RIGHT$(IDENT2$,16)+MID$(IDENT2$,3,1)
232 COMP1$=RIGHT$(IDENT1$,16)+MID$(IDENT1$,3,1)
240 IF COMP2$<COMP1$ THEN GOSUB 10000 ELSE 290
250 GOSUB 3000 ' LSET ID$=IDENT1$
260 PUT #1,TOP
270 GOSUB 4000 ' LSET ID$=IDENT2$
280 PUT #1,NXT
290 INDEX=INDEX+1
300 NXT=INDEX
305 'PRINT TOP:INDEX:NXT:IDENT1$:IDENT2$:BOTTOM
306 '
310 WEND
320 TOP = TOP + 1
325 GET #1,TOP
326 GOSUB 1000 '*****IDENT1$ = ID$
330 NXT=TOP+1
335 INDEX=NXT
336 'IF INTCGE$ = "F" THEN 350 ELSE INTCGE$ = "F"
340 WEND
350 PRINT "DONE" :STOP
360 INDEX=SQUACK : INDEX=1
370 WHILE INDEX <> INT(LOF(1)/255 +1) 'NOT EOF (1)
380 GET #1,INDEX
385 PRINT ID$,CVS(SUM$),INDEX
390 INDEX=INDEX+1
400 WEND
406 END
410 RETURN
1000 '***** GET 1'S
1010 IDENT1$ = ID$
1020 S1$ = SIZCAT$
1025 SU1 = CVS(SUM$)
1030 PA1 = CVS(PAREA$)
1040 MMD1 = CVS(MMD$)

```

Figure A-5. Qsort/asc

```

1041 NMD1 = CVS(NMD$)
1042 MD1 = CVS(MD$)
1043 ND1 = CVS(ND$)
1050 SIG1 = CVS(SIGMA$)
1060 DP1 = CVS(DROP$)
1070 L1 = CVS(LITER$)
1080 GAL1 = CVS(GAL$)
1090 GRAM1 = CVS(GRAM$)
1100 RETURN
2000 '***** GET 2'S
2010 IDENT2$ = ID$
2020 S2$ = SIZCAT$
2025 SU2 = CVS(SUM$)
2030 PA2 = CVS(PAREA$)
2040 MMD2 = CVS(MMD$)
2041 NMD2 = CVS(NMD$)
2042 MD2 = CVS(MD$)
2043 ND2 = CVS(ND$)
2050 SIG2 = CVS(SIGMA$)
2060 DP2 = CVS(DROP$)
2070 L2 = CVS(LITER$)
2080 GAL2 = CVS(GAL$)
2090 GRAM2 = CVS(GRAM$)
2100 RETURN
3000 '***** PUT 1'S
3010 LSET ID$ = IDENT1$
3020 LSET SIZCAT$ = S1$
3025 LSET SUM$ = MKS$(SU1)
3030 LSET PAREA$ = MKS$(PA1)
3040 LSET MMD$ = MKS$(MMD1)
3041 LSET NMD$ = MKS$(NMD1)
3042 LSET MD$ = MKS$(MD1)
3043 LSET ND$ = MKS$(ND1)
3050 LSET SIGMA$ = MKS$(SIG1)
3060 LSET DROP$ = MKS$(DP1)
3070 LSET LITER$ = MKS$(L1)
3080 LSET GAL$ = MKS$(GAL1)
3090 LSET GRAM$ = MKS$(GRAM1)
3100 RETURN
4000 '***** PUT 1'S
4010 LSET ID$ = IDENT2$
4020 LSET SIZCAT$ = S2$
4025 LSET SUM$ = MKS$(SU2)
4030 LSET PAREA$ = MKS$(PA2)
4040 LSET MMD$ = MKS$(MMD2)
4041 LSET NMD$ = MKS$(NMD2)
4042 LSET MD$ = MKS$(MD2)
4043 LSET ND$ = MKS$(ND2)
4050 LSET SIGMA$ = MKS$(SIG2)
4060 LSET DROP$ = MKS$(DP2)
4070 LSET LITER$ = MKS$(L2)
4080 LSET GAL$ = MKS$(GAL2)
4090 LSET GRAM$ = MKS$(GRAM2)
4100 RETURN

```

```

10000 '*****
10010 '***** SWAP 2 RECORDS *****
10020 '*****
10030 '
10040 SWAP IDENT2$,IDENT1$
10050 SWAP S2$,S1$
10060 SWAP SU2,SU1
10070 SWAP PA2,PA1
10080 SWAP MMD2,MMD1
10081 SWAP NMD2,NMD1
10082 SWAP MD2,MD1
10083 SWAP ND2,ND1
10090 SWAP SIG2,SIG1
10100 SWAP DP2,DP1
10110 SWAP L2,L1
10120 SWAP GAL2,GAL1
10130 SWAP GRAM2,GRAM1
10140 PRINT "SWAPPED ";TOP;" WITH ";NXT
10150 'GOSUB 360 :STOP
10160 RETURN

```

Blank

```

80 GOSUB 10000
90 WIDTH "LPT1:",132
95 'GOTO 140
100 GOSUB 1000 '***** SET-UP PRINTER *****
101 GOTO 465
110 GOSUB 500
140 INDEX = 1:TEST.NUM = 1
141 'OPEN A FILE ON DRIVE A: TO SAVE UNSORTED REDUCED DATA
142 OPEN "B: "+"CARD"+RIGHT$(STR$(TEST.NUM),LEN(STR$(TEST.NUM))-1)+".RAN" AS #1 :
EN=255
143 FIELD #1,20 AS INUM$,125 AS SIZCAT$,10 AS SUM$,10 AS PAREA$,10 AS MMD$,10 A
NMD$,10 AS MD$,10 AS ND$,10 AS SIGMA$,10 AS DROP$,10 AS LITER$,10 AS GAL$,10 A
GRAM$
144 'GOTO 723
145 WHILE NOT EOF(1)
150 GET #1,INDEX
156 GOSUB 2000 '***** PRINT CARD DATA
157 INDEX=INDEX +1
160 WEND :CLOSE
235 GOSUB 600
240 INDEX = 1
241 OPEN "B: "+"CARD"+RIGHT$(STR$(TEST.NUM),LEN(STR$(TEST.NUM))-1)+".RAN" AS #1
EN=255
242 FIELD #1,20 AS INUM$,125 AS SIZCAT$,10 AS SUM$,10 AS PAREA$,10 AS MMD$,10 A
NMD$,10 AS MD$,10 AS ND$,10 AS SIGMA$,10 AS DROP$,10 AS LITER$,10 AS GAL$,10 A
GRAM$
245 WHILE NOT EOF(1)
250 GET #1,INDEX
255 'PRINT INUM$;SIZCAT$,CVS(SUM$),CVS(PAREA$),CVS(MMD$),CVS(SIGMA$),CVS(DROP$)
CVS(LITER$),CVS(GAL$),CVS(GRAM$)
256 GOSUB 3000 '***** PRINT CARD DATA
257 INDEX=INDEX +1
260 WEND
335 GOSUB 700
340 INDEX = 1:LPRINT CHR$(15):CLOSE
341 OPEN "B: "+"SIZE"+RIGHT$(STR$(TEST.NUM),LEN(STR$(TEST.NUM))-1)+".RAN" AS #1 :
EN=140
342 FIELD #1,10 AS CAT$,10 AS SUPL$,10 AS SLWL$,10 AS SAV$,10 AS DUPL$,10 AS DL
L$,10 AS DAV$,20 AS MAVD$,10 AS DPSQCM$,10 AS MAREC$,10 AS CUM$,10 AS PMCAT$,10
AS CFMCAT$
345 WHILE NOT EOF(1)
350 GET #1,INDEX
356 GOSUB 4000 '***** PRINT CARD DATA
357 INDEX=INDEX +1
360 WEND
435 GOSUB 800
440 INDEX = 1:LPRINT CHR$(15):CLOSE
441 OPEN "B: "+"SIZE"+RIGHT$(STR$(TEST.NUM),LEN(STR$(TEST.NUM))-1)+".RAN" AS #1
EN=140
442 FIELD #1,10 AS CAT$,10 AS SUPL$,10 AS SLWL$,10 AS SAV$,10 AS DUPL$,10 AS DL
L$,10 AS DAV$,20 AS MAVD$,10 AS DPSQCM$,10 AS MAREC$,10 AS CUM$,10 AS PMCAT$,10
AS CFMCAT$
445 WHILE NOT EOF(1)

```

Figure A-6. Print.fin

```

450 GET #1,INDEX
456 GOSUB 5000 '***** PRINT CARD DATA
457 INDEX=INDEX +1
460 WEND
465 GOSUB 12000 '***** PRINT NUMBER STUFF *****
466 GOSUB 15000 '***** PRINT HEADER FOR NUMBER DATA *****

467 INDEX = 1:CLOSE
468 OPEN "B: "+"CARD"+RIGHT$(STR$(TEST.NUM),LEN(STR$(TEST.NUM))-1)+".RAN" AS #1
EN=255
469 FIELD #1,20 AS INUM$,125 AS SIZCAT$,10 AS SUM$,10 AS PAREA$,10 AS MMD$,10 AS
NMD$,10 AS MD$,10 AS ND$,10 AS SIGMA$,10 AS DROP$,10 AS LITER$,10 AS GAL$,10 AS
GRAM$
470 WHILE NOT EOF(1)
471 GET #1,INDEX
473 GOSUB 20000 '***** PRINT CARD DATA
474 INDEX=INDEX +1
475 WEND
476 END
500 '*****
510 '*****TITLES *****
515 PAGE=1 : LPRINT CHR$(15) : SKIP=11
520 '*****
521 LPRINT "CML MUN DEV DIV, MUN DIR, CRDC, US ARMY " TAB(55) TEST.NUM$ TAB(70)
DATE$ TAB(120) "PAGE " ;PAGE
522 FOR K=1 TO 3:LPRINT :NEXT K
523 LPRINT CHR$(27)"E" CHR$(27)"W"CHR$(1) TAB(1) "QUANTIMET 900 DATA ANALYSIS &
REDUCTION" CHR$(27)"W"CHR$(0) CHR$(27)"F"
524 FOR K=1 TO 3:LPRINT :NEXT K
530 LPRINT "***** RAW DATA TABUL
TION *****"
540 LPRINT :LPRINT
550 LPRINT "IDENTIFICATION" TAB(60) "SIZE CATEGORIES"
560 LPRINT "NUM 1 2 3 4 5 6 7 8 9 10 11 12 1
14 15 16 17 18 19 20 21 22 23 24 25 "
570 LPRINT
580 RETURN
600 '*****
610 '*****TITLES *****
615 PAGE=2 : LPRINT CHR$(15) : SKIP=11
620 '*****
621 LPRINT "CML MUN DEV DIV, MUN DIR, CRDC, US ARMY " TAB(55) TEST.NUM$ TAB(70)
DATE$ TAB(120) "PAGE " ;PAGE
622 FOR K=1 TO 3:LPRINT :NEXT K
623 LPRINT CHR$(27)"E" CHR$(27)"W"CHR$(1) TAB(1) "QUANTIMET 900 DATA ANALYSIS &
REDUCTION" CHR$(27)"W"CHR$(0) CHR$(27)"F"
624 FOR K=1 TO 3:LPRINT :NEXT K
630 LPRINT "***** ALL DATA CALCUL
ATED *****"
640 LPRINT :LPRINT
650 LPRINT "IDENTIFICATION" TAB(46) "DIAMETER (MICRONS)" TAB(72) "DEPOSITION
-----RECOVERY RATES-----"
651 LPRINT
652 LPRINT TAB(72) "DENSITY"

```

```

653 LPRINT TAB(46) "MASS" TAB(72) "DROPS/" TAB(86) "LITERS/" TAB(101) "GAL/" TAB
(119) "GRAMS/"
654 LPRINT "NUM" TAB(10) "CARD" TAB(21) "SUM" TAB(31) "%AREA" TAB(44) "MEDIAN"
AB(58) "SIGMA" TAB(72) "SQ. CM." TAB(86) "HECTARE" TAB(101) "ACRE" TAB(119) "SQ
M."
670 LPRINT
680 RETURN
700 '*****
710 '*****TITLES *****
715 PAGE=3 : LPRINT CHR$(15) : SKIP=11
720 '*****
721 LPRINT "CML MUN DEV DIV, MUN DIR, CRDC, US ARMY " TAB(55) TEST.NUM$ TAB(70)
DATE$ TAB(120) "PAGE " ;PAGE
722 FOR K=1 TO 3:LPRINT :NEXT K
723 LPRINT "NUMBER OF CARDS READ = " INT(LOF(1)/255)
724 FOR K=1 TO 3:LPRINT :NEXT K
730 LPRINT "*****" PARAMETI
RS *****
740 LPRINT :LPRINT
750 LPRINT "DENSITY OF LIQUID =" ;LIQDEN TAB(35) "SCAN AREA=" ;SCAN.AREA;" SQ. C
."
760 LPRINT " DROP DIAMETER = (" ;CONSTA;" *STAIN DIAMETER **(" ;CONSTB;" )"
770 LPRINT "*****" SIZE CATEGORY
DATA *****
780 LPRINT " SIZE " TAB(10) "----- STAIN DIAMETER (MICRONS) -----
----- DROP DIAMETER (MICRONS) ----- MASS OF "
790 LPRINT "CATEGORY" TAB(12) "UPPER LIMIT LOWER LIMIT AVERAGE
UPPER LIMIT LOWER LIMIT AVERAGE AVERAGE DROP (GM)"
795 'LPRINT "123456789012345678901234567890123456789012345678901234567890123456
89012345678901234567890123456789012345678901234567890123456789012"
799 RETURN
800 '*****
810 '*****TITLES *****
815 PAGE=4 : LPRINT CHR$(15) : SKIP=11
820 '*****
821 LPRINT "CML MUN DEV DIV, MUN DIR, CRDC, US ARMY " TAB(55) TEST.NUM$ TAB(70)
DATE$ TAB(120) "PAGE " ;PAGE
822 FOR K=1 TO 3:LPRINT :NEXT K
823 LPRINT "PERCENT THICKENER = " THICK
824 FOR K=1 TO 3:LPRINT :NEXT K
830 LPRINT "*****" SUMMARY FOR ALL
DATA *****
840 LPRINT :LPRINT
850 LPRINT TAB(6) "DIAMETER (MICRONS)" TAB(32) "DEPOSITION
-----RECOVERY RATES-----"
851 'LPRINT
852 LPRINT TAB(32) "DENSITY"
853 LPRINT "MASS" TAB(10) "SIGMA" TAB(30) "DROPS/SQ. CM." TAB(60) "LITERS/HECTA
E" TAB(90) "GAL/ACRE" TAB(120) "GRAMS/SQ. M."
854 OPEN "B:"+"OVER"+RIGHT$(STR$(TEST.NUM),LEN(STR$(TEST.NUM))-1)+".RAN" AS #2
EN=90
855 FIELD #2,10 AS TMMD$,10 AS TNMD$,10 AS TMD$,10 AS TND$,10 AS TSIGMA$,10 AS
DPSCM$,10 AS TLPH$,10 AS TGPA$,10 AS TGPSM$
856 GET #2,1

```

```

857 TEST.MMD = CVS(TMMD$)
858 TEST.SIGMA = CVS(TSIGMA$)
859 TEST.DROPS = CVS(TDPSCM$)
860 TEST.LITERS = CVS(TLPH$)
861 TEST.GAL = CVS(TGPA$)
862 TEST.GRAMS = CVS(TGPSM$)
863 LPRINT "MEAN"
864 LPRINT
865 LPRINT TEST.MMD TAB(10) TEST.SIGMA TAB(30) TEST.DROPS TAB(60) TEST.LITERS T
B(90) TEST.GAL TAB(120) TEST.GRAMS
866 CLOSE #2
867 LPRINT :LPRINT
870 LPRINT "*****" TOTAL SUMMAI
Y *****"
871 LPRINT
872 LPRINT "          COUNTS IN          MASS          CUMULATIVE
          PERCENT MASS "
873 LPRINT "  SIZE          CATEGORY          RECOVERED          MASS
          CATEGORY          CUMULATIVE"
874 LPRINT "CATEGORY          DROPS/SQ. CM.          GM/SQ.M          GM.

899 RETURN
1000 '*****
1010 '***** SET-UP PRINTER *****
1030 '*****
1040 LPRINT CHR$(27)"N"CHR$(12)
1050 LPRINT CH$(15)
1060 RETURN
2000 IF INDEX = SKIP THEN LPRINT :SKIP = SKIP+10
2005 IF ASC(SIZCAT$)=0 THEN 2020
2006 LPRINT INDEX;
2010 LPRINT TAB(7) SIZCAT$
2020 RETURN
3000 IF INDEX = SKIP THEN LPRINT :SKIP = SKIP+10
3005 IF ASC(SIZCAT$)=0 THEN 3020
3006 LPRINT INDEX;
3010 LPRINT TAB(7) LEFT$(INUM$,13);TAB(20) STR$(CVS(SUM$));TAB(30) STR$(CVS(PARI
A$));TAB(45) STR$(CVS(MMD$));TAB(57) STR$(CVS(SIGMA$));TAB(71) STR$(CVS(DROP$));
TAB(85) STR$(CVS(LITER$));TAB(100) STR$(CVS(GAL$));TAB(118) STR$(CVS(GRAM$))
3020 RETURN
4000 IF INDEX = SKIP THEN LPRINT :SKIP = SKIP+10
4005 IF INDEX=26 THEN 4020
4006 LPRINT INDEX;
4010 'LPRINT TAB(7) LEFT$(INUM$,13);TAB(20) STR$(CVS(SUM$));TAB(30) STR$(CVS(PAI
EA$));TAB(45) STR$(CVS(MMD$));TAB(57) STR$(CVS(SIGMA$));TAB(71) STR$(CVS(DROP$)
;TAB(85) STR$(CVS(LITER$));TAB(100) STR$(CVS(GAL$));TAB(118) STR$(CVS(GRAM$))
4015 LPRINT TAB(12) CVS(SUPL$) TAB(28) CVS(SLWL$) TAB(44) CVS(SAV$) TAB(61) CV
(DUPL$) TAB(77) CVS(DLWL$) TAB(93) CVS(DAV$) TAB(107) CVS(MAVD$) ; CVS(DPSQ
M$); CVS(MAREC$); CVS(CUM$); CVS(PMCAT$); CVS(CPMCAT$)
4020 RETURN
5000 IF INDEX = SKIP THEN LPRINT :SKIP = SKIP+10
5003 IF CVS(CAT$)=26 THEN 5020
5004 LPRINT INDEX;
5010 'LPRINT TAB(7) LEFT$(INUM$,13);TAB(20) STR$(CVS(SUM$));TAB(30) STR$(CVS(PA

```



```

EA$));TAB(45) STR$(CVS(MMD$));TAB(57) STR$(CVS(SIGMA$));TAB(71) STR$(CVS(DROP$)
;TAB(85) STR$(CVS(LITER$));TAB(100) STR$(CVS(GAL$));TAB(118) STR$(CVS(GRAM$))
5015 LPRINT TAB(15) CVS(DPSQCM$) TAB(37) CVS(MAREC$) TAB(60) CVS(CUM$) TAB(80)
CVS(PMCAT$) TAB(100) CVS(CPMCAT$)
5020 RETURN
10000 INPUT "ENTER PERCENT THICKENER ";THICK
10010 INPUT "DENSITY OF LIQUID ";LIQDEN
10020 INPUT "ENTER SCAN AREA ";SCAN.AREA
10030 INPUT "ENTER DROP DIAMETER CONSTANT A ";CONSTA
10040 INPUT "ENTER DROP DIAMETER CONSTANT B ";CONSTB
10050 INPUT "ENTER TEST NUMBER ";TEST.NUM$
10060 RETURN
12000 '*****
12010 '***** NUMBER MEAN,MEDIAN & MASS MEAN *****
12020 '*****
12030 TEST.NUM = 1:CLOSE
12040 OPEN "B: "+"CARD"+RIGHT$(STR$(TEST.NUM),LEN(STR$(TEST.NUM))-1)+".RAN" AS #
LEN=255
12050 FIELD #1,20 AS INUM$,125 AS SIZCAT$,10 AS SUM$,10 AS PAREA$,10 AS MMD$,10
AS NMD$,10 AS MD$,10 AS ND$,10 AS SIGMA$,10 AS DROP$,10 AS LITER$,10 AS GAL$,10
AS GRAM$
12060 '*****
12070 '*****TITLES *****
12080 PAGE=5 : LPRINT CHR$(15) : SKIP=11
12090 '*****
13000 LPRINT "CML MUN DEV DIV, MUN DIR, CRDC, US ARMY " TAB(55) TEST.NUM$ TAB(7
) DATE$ TAB(120) "PAGE ";PAGE
13010 FOR K=1 TO 3:LPRINT :NEXT K
13020 LPRINT "PERCENT THICKENER = " THICK
13030 FOR K=1 TO 3:LPRINT :NEXT K
13040 LPRINT "***** SUMMARY FOR A
L DATA *****"
13050 LPRINT :LPRINT
13061 'LPRINT
13063 LPRINT "NUMBER" TAB(30) "MASS" TAB(45) "NUMBER"
13064 OPEN "B: "+"OVER"+RIGHT$(STR$(TEST.NUM),LEN(STR$(TEST.NUM))-1)+".RAN" AS #
LEN=90
13065 FIELD #2,10 AS TMMD$,10 AS TNMD$,10 AS TMD$,10 AS TND$,10 AS TSIGMA$,10 A
TDPSCM$,10 AS TLPH$,10 AS TGPA$,10 AS TGPSM$
13070 GET #2,1
13080 TEST.NMD = CVS(TNMD$)
13090 TEST.MD = CVS(TMD$)
14000 TEST.ND = CVS(TND$)
14010 LPRINT "MEDIAN" TAB(30) "MEAN" TAB(45) "MEAN"
14020 LPRINT
14030 LPRINT TEST.NMD TAB(30) TEST.MD TAB(45) TEST.ND
14040 CLOSE #2
14050 LPRINT :LPRINT
14060 LPRINT "***** TOTAL SUM
ARY *****"
15000 LPRINT "***** ALL DATA CAL
ULATED *****"
15010 LPRINT :LPRINT
15020 LPRINT "IDENTIFICATION" TAB(46) "DIAMETER (MICRONS)"

```

```
15030 LPRINT
15050 LPRINT TAB(44) "NUMBER" TAB(72) "MASS" TAB(101) "NUMBER"
15060 LPRINT "NUM" TAB(10) "CARD" TAB(44) "MEDIAN" TAB(72) "MEAN" TAB(101) "MEAN"
15070 LPRINT
15080 RETURN
20000 IF INDEX = SKIP THEN LPRINT :SKIP = SKIP+10
20005 IF ASC(SIZCAT$)=0 THEN 20020
20006 LPRINT INDEX;
20010 LPRINT TAB(7) LEFT$(INUM$,13);TAB(45) STR$(CVS(NMD$));TAB(72) STR$(CVS(MD$));TAB(100) STR$(CVS(ND$))
20020 RETURN
```

SAMPLE PRINTOUT

47

Blank

QUANTIMET 900 DATA ANALYSIS & REDUCTION

RAW DATA TABULATION

IDENTIFICATION										SIZE CATEGORIES															
NUM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1	0	0	3	1	1	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
6	0	0	12	7	10	2	3	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	3	3	2	1	2	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	1	3	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0
10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	2	23	28	16	6	3	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	51	49	17	17	14	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	12	11	12	26	18	13	1	1	0	0	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0
14	1	0	1	9	13	5	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	1	0	11	16	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	1	0	5	15	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	2	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	82	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	12	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	42	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	1	4	24	9	9	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	12	33	12	7	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
31	4	1	43	43	26	11	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	1	2	133	66	25	6	4	2	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
33	11	97	188	45	15	3	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

34	23	299	214	52	12	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	47	392	187	44	11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	198	484	157	29	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	311	395	99	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	428	378	96	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	297	366	69	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	35	52	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	192	210	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	151	172	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	146	94	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	205	149	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	176	197	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	220	132	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	64	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	96	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	4	2	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	5	2	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	4	9	4	4	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	6	8	8	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	6	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	2	2	2	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	1	2	6	3	1	0	0	2	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	6	4	3	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	1	2	0	1	0	0	0	1	1	0	1	0	0	0
63	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	17	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	24	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	26	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	27	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	28	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	33	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	18	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	81	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	35	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

83	60	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	42	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85	42	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	47	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
87	24	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	54	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	49	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	41	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	26	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
106	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
107	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
108	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
111	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
112	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
113	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
114	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
116	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
117	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
118	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
119	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
121	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
122	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
123	16	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
124	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

CML MUN DEV DIV, MUN DIR, CRDC, US ARMY

TEST NUMBER 3 10-19-1984

PAGE 2

ALL DATA CALCULATED

IDENTIFICATION				DIAMETER (MICRONS)		DEPOSITION	-----RECOVERY RATES-----			
NUM	CARD	SUM	XAREA	MASS MEAN	SIGMA	DENSITY DROPS/ SQ. CM.	LITERS/ HECTARE	GAL/ ACRE	GRAMS/ SQ. M.	
1	3-A-050-005	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07	
2	3-A-060-005	4	1.130318	1119.636	1	.189394	15.76958	1.685493E-03	1.655806	
3	3-A-060-010	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07	
4	3-A-070-005	10	2.293042	1290.241	1.2595	.4734849	34.12921	3.647819E-03	3.583567	
5	3-A-075-015	1	1.729674	2594.581	1	4.734849E-02	47.38635	5.064776E-03	4.975567	
6	3-A-080-005	37	7.194077	2276.063	1.07019	1.751894	121.6232	1.299941E-02	12.77044	
7	3-A-090-010	14	7.728638	2594.581	1.121337	.6628788	172.1004	1.839453E-02	18.07054	
8	3-A-080-015	1	.5201622	1458.603	1	4.734849E-02	9.094669	9.720618E-04	.9549404	
9	3-A-080-015	9	8.612374	2594.581	1.060834	.4261364	205.4402	2.195799E-02	21.57123	
10	3-A-080-020	2	3.61612E-03	13.53013	1	9.469698E-02	1.228118E-05	1.312644E-09	1.289524E-06	
11	3-A-090-005	90	5.673205	769.4668	2.326103	3.787879	60.69797	6.487557E-03	6.373287	
12	3-A-090-010	155	6.888517	769.4668	1.229813	7.339016	66.026	7.057029E-03	6.932729	
13	3-A-090-015	98	13.22194	1290.241	1.76406	4.640152	190.4891	2.035997E-02	20.00136	
14	3-A-090-020	34	5.547206	946.2999	1.363459	1.609849	67.34973	7.198513E-03	7.071721	
15	3-A-090-025	37	3.219974	587.7394	1.309197	1.751894	29.92804	3.198786E-03	3.142444	
16	3-A-090-030	24	1.987064	587.7394	1.309197	1.136364	17.91529	1.914833E-03	1.881106	
17	3-A-090-035	11	.8837358	587.7394	1	.5208334	7.620434	8.144917E-04	.8001455	
18	3-A-090-040	86	.270652	397.6448	1	4.07197	.7371205	7.878535E-05	7.739766E-02	
19	3-A-090-040	6	.1835866	397.6448	1	.2840909	1.104926	1.180973E-04	.1160172	
20	3-A-090-045	2	3.61612E-03	13.53013	1	9.469698E-02	1.228118E-05	1.312644E-09	1.289524E-06	
21	3-A-090-070	1	1.619882E-02	156.6992	1	4.734849E-02	6.684909E-02	7.145004E-06	7.019155E-03	
22	3-A-090-075	7	.0558287	156.6992	1	.3314394	.2005719	2.143764E-05	2.106005E-02	
23	3-A-090-080	7	2.704718E-02	156.6992	1	.3314394	6.688594E-02	7.148943E-06	7.023023E-03	
24	3-A-090-085	11	4.867018E-02	156.6992	1	.5208334	.1337535	1.429592E-05	1.404411E-02	
25	3-A-090-090	13	3.789554E-02	156.6992	1	.6155303	6.692278E-02	7.15288E-06	7.026892E-03	
26	3-A-090-095	8	4.324601E-02	156.6992	1	.3787879	.133735	1.429395E-05	1.404218E-02	
27	3-A-090-100	7	1.265642E-02	13.53013	1	.3314394	4.298412E-05	4.594255E-09	4.513333E-06	
28	3-A-095-100	51	.2217279	156.6992	1	2.414773	.6018998	6.433261E-05	6.319948E-02	
29	3-A-100-005	50	3.905724	769.4668	1.229813	2.367424	36.87193	3.940968E-03	3.871552	
30	3-A-100-010	67	10.27185	2435.82	1	3.172349	155.3793	1.660734E-02	16.31482	
31	3-A-100-015	136	14.47098	769.4668	1.45508	6.439394	154.3697	1.649944E-02	16.20882	
32	3-A-100-020	242	21.11248	769.4668	2.111928	11.45833	225.3469	2.408566E-02	23.66142	
33	3-A-100-025	365	18.78532	587.7394	1.904987	17.2822	158.185	1.690722E-02	16.60942	
34	3-A-100-030	606	22.15658	397.6448	1.935061	28.69319	160.3257	1.713602E-02	16.8342	
35	3-A-100-035	682	20.55129	397.6448	1.478051	32.29167	136.9023	1.463247E-02	14.37474	
36	3-A-100-040	874	18.76706	397.6448	1.478051	41.38258	112.8894	1.206591E-02	11.85339	
37	3-A-100-045	816	12.44324	397.6448	1	38.63637	65.61974	7.013607E-03	6.890073	
38	3-A-100-050	910	11.92224	397.6448	1	43.08713	60.44949	6.460998E-03	6.347196	
39	3-A-100-055	737	10.01151	397.6448	1	34.89594	49.16791	5.255194E-03	5.162631	
40	3-A-100-060	95	1.265595	156.6992	2.537632	4.498106	5.888044	6.293294E-04	.6182445	
41	3-A-100-065	449	5.863746	397.6448	1	21.25947	28.20808	3.014953E-03	2.961849	

42	3-A-100-070	358	4.6341	156.6992	2.537632	16.95076	22.05005	2.356767E-03	2.315255
43	3-A-100-075	260	2.686601	156.6992	2.537632	12.31061	12.3139	1.316142E-03	1.29296
44	3-A-100-080	361	3.099254	156.6992	2.537632	17.0928	12.07199	1.290286E-03	1.267559
45	3-A-100-085	382	3.914357	156.6992	2.537632	18.08712	15.88348	1.697668E-03	1.667766
46	3-A-100-090	353	2.581015	156.6992	1	16.71402	9.126892	9.755059E-04	.9583236
47	3-A-100-095	98	.6664758	156.6992	1	4.640152	2.273262	2.429722E-04	.2386925
48	3-A-100-100	141	.9025208	156.6992	1	6.676137	3.008799	3.215882E-04	.3159239
49	3-A-105-005	2	3.61612E-03	13.53013	1	9.469698E-02	1.228118E-05	1.312644E-09	1.289524E-06
50	3-A-105-010	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
51	3-A-105-015	3	5.42418E-03	13.53013	1	.1420455	1.842177E-05	1.968967E-09	1.934286E-06
52	3-A-105-030	2	3.61612E-03	13.53013	1	9.469698E-02	1.228118E-05	1.312644E-09	1.289524E-06
53	3-A-110-005	9	2.118446	1953.196	1	.4261364	34.22059	3.657586E-03	3.593162
54	3-A-110-010	10	2.20664	1953.196	1	.4734849	35.00032	3.740925E-03	3.675033
55	3-A-110-010	25	5.617392	1119.636	1.152376	1.183712	77.26538	8.258323E-03	8.112865
56	3-A-110-015	17	3.630336	946.2999	1.183172	.8049243	46.46377	4.966168E-03	4.878696
57	3-A-110-020	13	1.92406	946.2999	1.183172	.6155303	21.94975	2.346046E-03	2.304723
58	3-A-110-025	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
59	3-A-120-005	11	3.15977	1290.241	1.130489	.5208334	47.69899	5.098192E-03	5.008394
60	3-A-120-010	15	7.71604	1458.603	1.45017	.7102273	142.2262	.0152015	14.93375
61	3-A-130-005	15	4.1307	1119.636	1.744492	.7102273	63.38216	6.774449E-03	6.655127
62	3-A-130-010	7	10.26465	2909.399	1.107102	.3314394	282.47	3.019112E-02	29.65935
63	3-A-150-005	1	.5201622	1458.603	1	4.734849E-02	9.094669	9.720618E-04	.9549404
64	3-A-170-010	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
65	3-B-090-010	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
66	3-B-090-020	3	5.42418E-03	13.53013	1	.1420455	1.842177E-05	1.968967E-09	1.934286E-06
67	3-B-090-030	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
68	3-B-090-040	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
69	3-B-090-050	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
70	3-B-090-060	3	5.42418E-03	13.53013	1	.1420455	1.842177E-05	1.968967E-09	1.934286E-06
71	3-B-095-010	28	.2089241	156.6992	1	1.325758	.7354445	7.86062E-05	7.722166E-02
72	3-B-095-020	40	.2737931	156.6992	1	1.89394	.936047	1.000471E-04	9.828493E-02
73	3-B-095-030	36	.2089978	156.6992	1	1.704546	.6686505	7.14671E-05	.0702083
74	3-B-095-040	30	9.741408E-02	156.6992	1	1.420455	.2007131	2.145273E-05	2.107487E-02
75	3-B-095-050	33	.1316198	156.6992	1	1.5625	.3344174	3.57434E-05	3.511383E-02
76	3-B-095-060	31	7.044061E-02	156.6992	1	1.467803	6.703331E-02	7.164694E-06	7.038498E-03
77	3-B-095-070	35	9.206362E-02	156.6992	1	1.657197	.1339008	1.431167E-05	1.405959E-02
78	3-B-095-080	19	.0487439	156.6992	1	.8996212	6.695963E-02	7.156819E-06	7.03076E-03
79	3-B-095-090	5	9.040299E-03	13.53013	1	.2367424	3.070295E-05	3.281611E-09	3.22381E-06
80	3-B-095-100	4	7.23224E-03	13.53013	1	.189394	2.456236E-05	2.625289E-09	2.579048E-06
81	3-B-100-010	117	.7296104	156.6992	1	5.539773	2.407065	2.572733E-04	.2527418
82	3-B-100-020	46	.2414691	156.6992	1	2.178031	.735555	7.861803E-05	7.723327E-02
83	3-B-100-030	82	.4648577	156.6992	1	3.892576	1.471049	1.572295E-04	.1544601
84	3-B-100-040	82	.7238914	156.6992	1	3.882576	2.674222	2.859278E-04	.2807933
85	3-B-100-050	58	.3351197	156.6992	1	2.746212	1.069843	1.143476E-04	.1123336
86	3-B-100-060	84	.6843353	156.6992	1	3.977273	2.473705	2.64396E-04	.2597391
87	3-B-100-070	29	.1243876	156.6992	1	1.373106	.3343929	3.574077E-05	3.511125E-02
88	3-B-100-080	63	.2434246	156.6992	1	2.982955	.6019735	6.434048E-05	6.320721E-02
89	3-B-100-090	54	.169589	156.6992	1	2.556818	.3345464	3.575718E-05	3.512737E-02
90	3-B-100-100	49	.203721	156.6992	1	2.320076	.5350446	5.718695E-05	5.617967E-02

91	3-B-102.5-100	28	.0794072	156.6992	1	1.325758	.1339579	1.430707E-05	1.405507E-02
92	3-B-105-010	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
93	3-B-105-020	3	5.42418E-03	13.53013	1	.1420455	1.842177E-05	1.968967E-09	1.934286E-06
94	3-B-105-030	2	3.61612E-03	13.53013	1	9.469698E-02	1.228118E-05	1.312644E-09	1.289524E-06
95	3-B-105-040	5	2.343106E-02	156.6992	1	.2367424	6.687366E-02	7.14763E-06	7.021734E-03
96	3-B-105-050	3	5.42418E-03	13.53013	1	.1420455	1.842177E-05	1.968967E-09	1.934286E-06
97	3-B-105-060	10	.0180806	13.53013	1	.4734849	6.14059E-05	6.563222E-09	6.447619E-06
98	3-B-105-070	5	9.040299E-03	13.53013	1	.2367424	3.070295E-05	3.281611E-09	3.22381E-06
99	3-B-105-080	3	5.42418E-03	13.53013	1	.1420455	1.842177E-05	1.968967E-09	1.934286E-06
100	3-B-105-090	7	1.265642E-02	13.53013	1	.3314394	4.298412E-05	4.594255E-09	4.513333E-06
101	3-B-105-100	5	9.040299E-03	13.53013	1	.2367424	3.070295E-05	3.281611E-09	3.22381E-06
102	3-B-107.5-100	2	3.61612E-03	13.53013	1	9.469698E-02	1.228118E-05	1.312644E-09	1.289524E-06
103	3-B-110-080	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
104	3-B-110-090	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
105	3-B-110-100	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
106	3-C-100-020	11	1.988866E-02	13.53013	1	.5208334	6.754648E-05	7.219543E-09	7.092381E-06
107	3-C-100-040	11	1.988866E-02	13.53013	1	.5208334	6.754648E-05	7.219543E-09	7.092381E-06
108	3-C-100-060	6	1.084836E-02	13.53013	1	.2840909	3.684354E-05	3.937933E-09	3.868572E-06
109	3-C-100-100	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
110	3-C-102.5-020	24	4.339344E-02	13.53013	1	1.136364	1.473742E-04	1.575173E-08	1.547429E-05
111	3-C-102.5-040	12	2.169672E-02	13.53013	1	.5681819	7.368709E-05	7.875866E-09	7.737143E-06
112	3-C-102.5-060	11	1.988866E-02	13.53013	1	.5208334	6.754648E-05	7.219543E-09	7.092381E-06
113	3-C-102.5-080	7	1.265642E-02	13.53013	1	.3314394	4.298412E-05	4.594255E-09	4.513333E-06
114	3-C-102.5-100	3	5.42418E-03	13.53013	1	.1420455	1.842177E-05	1.968967E-09	1.934286E-06
115	3-C-105-020	4	7.23224E-03	13.53013	1	.189394	2.456236E-05	2.625289E-09	2.579048E-06
116	3-C-105-040	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
117	3-C-105-060	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
118	3-C-105-080	1	1.80806E-03	13.53013	1	4.734849E-02	6.14059E-06	6.563221E-10	6.447619E-07
119	3-C-105-100	2	3.61612E-03	13.53013	1	9.469698E-02	1.228118E-05	1.312644E-09	1.289524E-06
120	3-C-107.5-040	2	3.61612E-03	13.53013	1	9.469698E-02	1.228118E-05	1.312644E-09	1.289524E-06
121	3-C-92.5-000	7	1.265642E-02	13.53013	1	.3314394	4.298412E-05	4.594255E-09	4.513333E-06
122	3-C-92.5-020	7	2.704718E-02	156.6992	1	.3314394	6.688594E-02	7.146943E-06	7.023023E-03
123	3-C-97.5-020	22	.1837177	397.6448	1	1.041667	.8704136	9.303205E-05	9.139342E-02
124	3-C-97.5-100	2	3.61612E-03	13.53013	1	9.469698E-02	1.228118E-05	1.312644E-09	1.289524E-06

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NUMBER OF CARDS READ = 348.75

***** PARAMETERS *****

DENSITY OF LIQUID = 1.05 SCAN AREA= 21.12 SQ. CM.
 DRCP DIAMETER = (.8380001 *STAIN DIAMETER **(.914)

***** SIZE CATEGORY DATA *****

SIZE	STAIN DIAMETER (MICRONS)			DROP DIAMETER (MICRONS)			MASS OF
CATEGORY	UPPER LIMIT	LOWER LIMIT	AVERAGE	UPPER LIMIT	LOWER LIMIT	AVERAGE	AVERAGE DROP (GM)

1	440	1	220.5	218.454	.8380001	13.53013	1.361737E-09
2	890	440	660	411.6245	218.454	299.8682	1.482446E-05
3	1320	880	1100	596.2777	411.6245	495.4215	6.685165E-05
4	1760	1320	1540	775.6084	596.2777	680.0573	1.729116E-04
5	2200	1760	1980	951.0836	775.6084	858.8762	3.483207E-04
6	2640	2200	2420	1123.544	951.0836	1033.724	6.072964E-04
7	3080	2640	2860	1293.539	1123.544	1205.548	9.632549E-04
8	3520	3080	3300	1461.45	1293.539	1374.934	1.429001E-03
9	3960	3520	3740	1627.562	1461.45	1542.272	2.016834E-03
10	4400	3960	4180	1792.09	1627.562	1707.846	2.738629E-03
11	4840	4400	4620	1955.206	1792.09	1871.872	3.605918E-03
12	5280	4840	5060	2117.053	1955.206	2034.52	4.629919E-03
13	5720	5280	5500	2277.739	2117.053	2195.924	5.821563E-03
14	6160	5720	5940	2437.365	2277.739	2356.201	7.191591E-03
15	6600	6160	6380	2596.016	2437.365	2515.439	8.750422E-03
16	7040	6600	6820	2753.757	2596.016	2673.723	.0105084
17	7480	7040	7260	2910.651	2753.757	2831.115	1.247556E-02
18	7920	7480	7700	3066.753	2910.651	2987.683	1.466192E-02
19	8360	7920	8140	3222.114	3066.753	3143.472	1.707718E-02
20	8800	8360	8580	3376.768	3222.114	3298.533	1.973104E-02
21	9240	8800	9020	3530.761	3376.768	3452.906	2.263298E-02
22	9680	9240	9460	3684.123	3530.761	3606.628	2.579239E-02
23	10120	9680	9900	3836.889	3684.123	3759.73	2.921848E-02
24	10560	10120	10340	3989.082	3836.889	3912.244	3.292042E-02
25	11000	10560	10780	4140.733	3989.082	4064.202	3.690738E-02

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PERCENT THICKENER = 4.9

***** SUMMARY FOR ALL DATA *****					
DIAMETER (MICRONS)		DEPOSITION DENSITY	-----RECOVERY RATES-----		
MASS	SIGMA	DROPS/SQ. CM.	LITERS/HECTARE	GAL/ACRE	GRAMS/SQ. M.
MEAN					
946.2999					
	2.574046	3.810792	26.22343	2.802829E-03	2.75346
***** TOTAL SUMMARY *****					
SIZE CATEGORY	COUNTS IN CATEGORY	MASS RECOVERED	CUMULATIVE MASS	PERCENT MASS CATEGORY	CUMULATIVE
	DROPS/SQ. CM.	GM/SQ. M	GM.		

1	7.121212	9.697219E-05	5.120132E-06	7.100463E-04	7.100463E-04
2	7.299243	1.082073	5.713856E-02	7.923115	7.923825
3	2.734849	1.828291	.1536723	13.38705	21.31087
4	.9147728	1.581748	.2371886	11.58182	32.89269
5	.4223485	1.471127	.3148641	10.77183	43.66453
6	.1799243	1.092673	.3725573	8.000735	51.66526
7	8.901515E-02	.8574429	.4178302	6.278338	57.9436
8	4.545455E-02	.649546	.4521263	4.756082	62.69968
9	2.840909E-02	.5729643	.4823788	4.195338	66.89501
10	1.325758E-02	.3630758	.5015492	2.658501	69.55351
11	1.136364E-02	.4097634	.5231847	3.000355	72.55386
12	5.681819E-03	.2630636	.5370745	1.926195	74.48006
13	9.469698E-03	.5512845	.5661823	4.036595	78.51666
14	3.787879E-03	.2724084	.5805654	1.994619	80.51128
15	7.575758E-03	.6629108	.6155671	4.853942	85.36522
16	5.681819E-03	.597068	.6470923	4.37183	89.73704
17	3.787879E-03	.472559	.6720434	3.460155	93.1972
18	3.787879E-03	.5553758	.7013672	4.066553	97.26375
19	0	0	.7013672	0	97.26375
20	1.89394E-03	.3736939	.7210983	2.736248	100
21	0	0	.7210983	0	100
22	0	0	.7210983	0	100
23	0	0	.7210983	0	100
24	0	0	.7210983	0	100
25	0	0	.7210983	0	100
26	0	0	0	0	0

END

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DTIC